E. S. B. – Type A
Vol. II

These are first nest-boosted cells made.

O.A Cells #478, #479, #490.

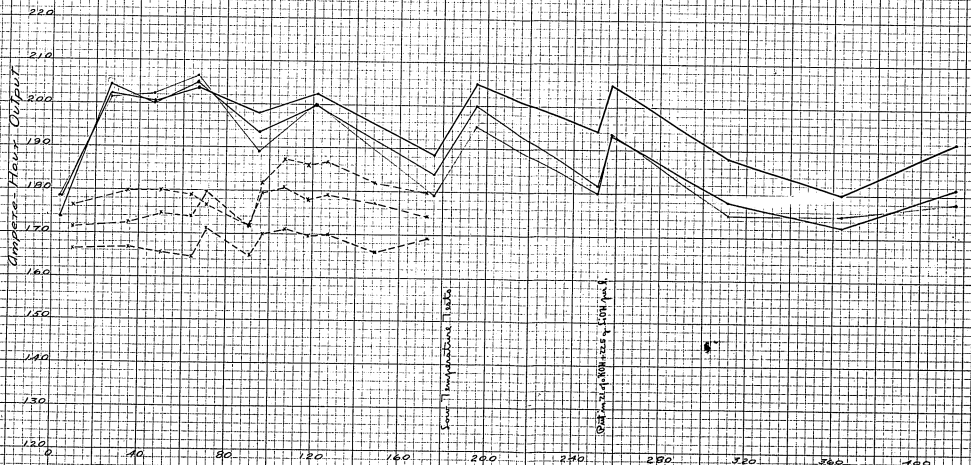
Life-Curves of Cells which have Different Amounts of LiOH in the 21% KOH Electrolyte.

#478 (Black), 90g LiOH. #479 (Red) 105 g LiOH. #480 (Green), 120g LiOH

Full line: Output to 1.1 V. at 30 amps, on a 5 hour charge at 30 amps.

Dotted line: " " .5 V. " 40 " " " 7 " " " "
30 amps.

Edison Laboratory — last O.K.-W.E.M. Plotted by A.C.



O-A Cells "A18," "A19," "A80.

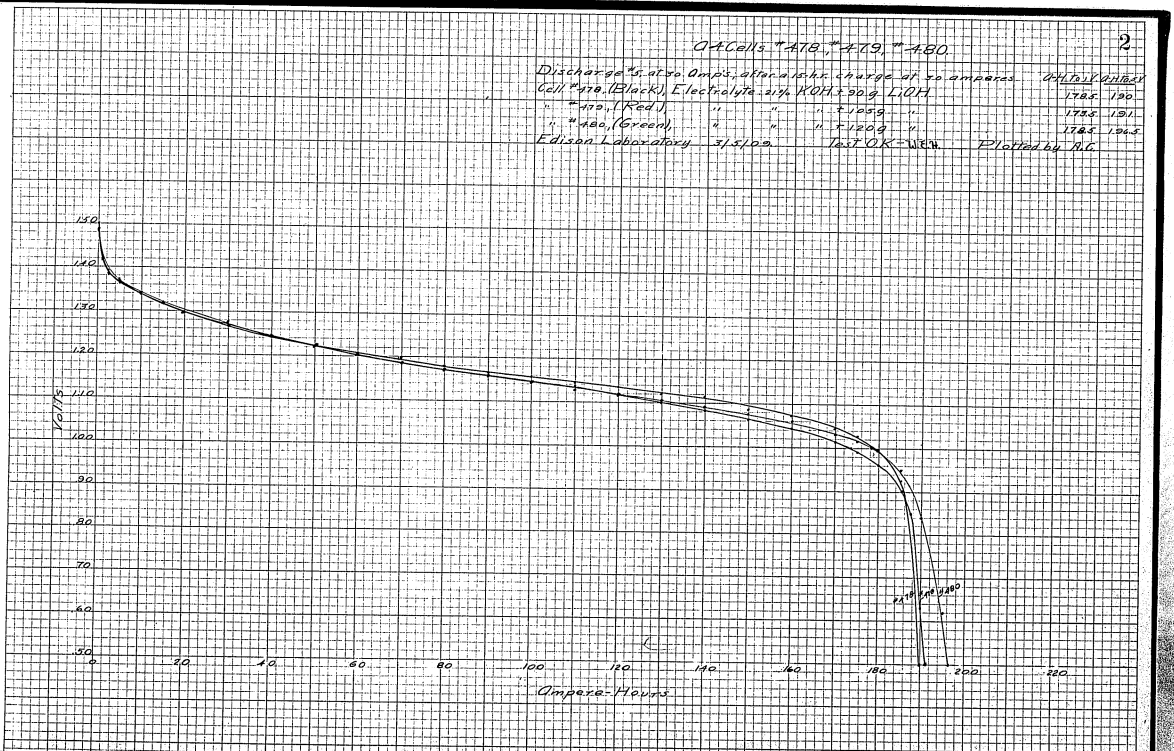
Discharge "5 at to 0 mpt. after a 5 hr. charge at 10 amperes — Ah. to 1 Volt — Ah. to 1 Volt

Cell "A18, (Black), Electrolyte 21% KOH + 30 g. LiOH — 178.5 — 190

" "A19, (Red), " " " + 105 g. " — 173.5 — 191

" "A80, (Green), " " " + 120 g. " — 178.5 — 194.5

Edison Laboratory 3/5/09 Test OK - WEH Plotted by AC

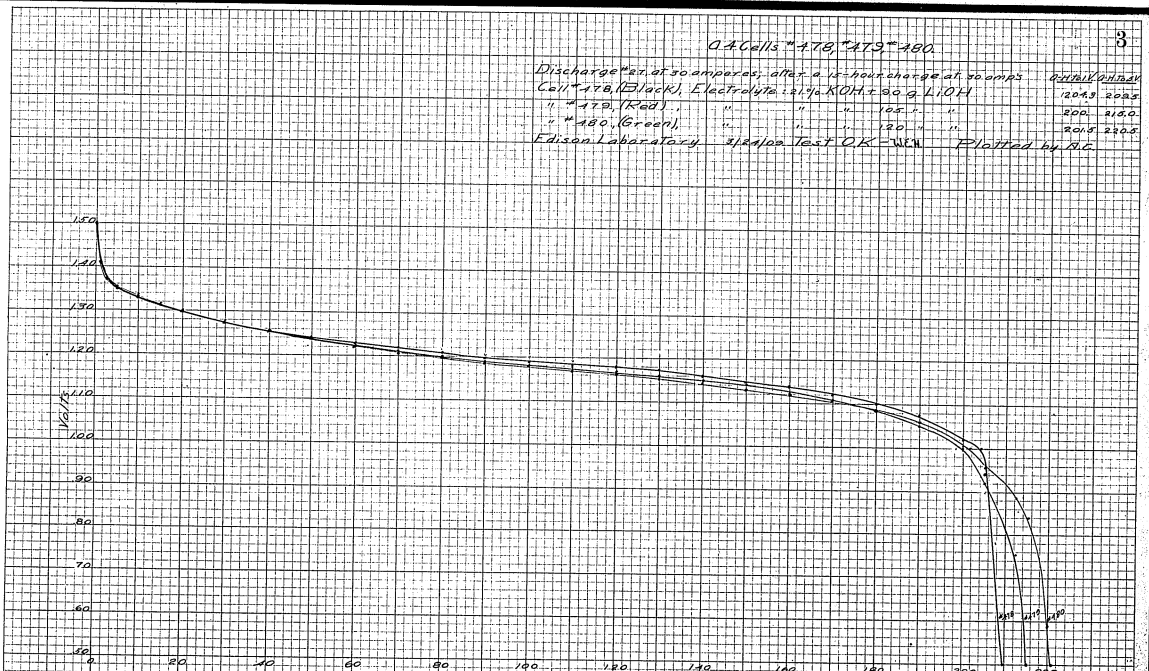


0.4 Cells #478, #479 #480.

Discharge #27, at 30 amperes, after a 15-hour charge at 30 amps

		Ampere-Hours	Volts
Cell #478, (Black), Electrolyte: 21% KOH + 60 g. LiOH		204.9	200
" #479, (Red), " " " " 105 " "		200.	210.0
" #480, (Green), " " " " 120 " "		201.5	210.5

Edison Laboratory 3/24/09 Test OK - WEH Plotted by AC



04 Cells, #476, #479, #480.

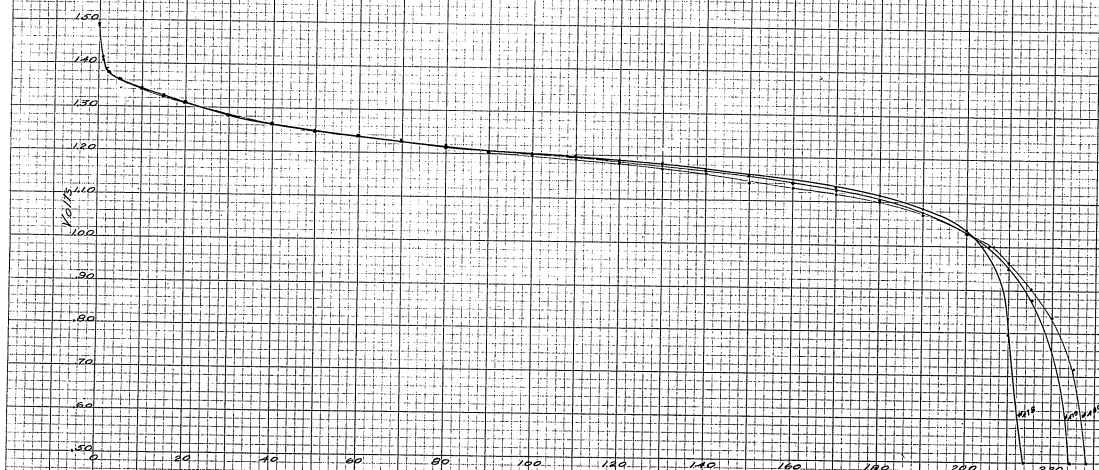
Discharge Test, at 30 Amperes; after a 15 hour charge at 30 amps. 6 Volts @ 1 Test

Cell #476, (Black). Electrolyte: 21% KOH + 30 g LiOH. 203.6 214

" #479, (Red), " " " + 105 g " 205 224.3

" #480, (Green), " " " + 120 g " 206.2 228.5

Edison Laboratory, 4/2 x/03. Test O.K. - W.H.H. Plotted by A.C.

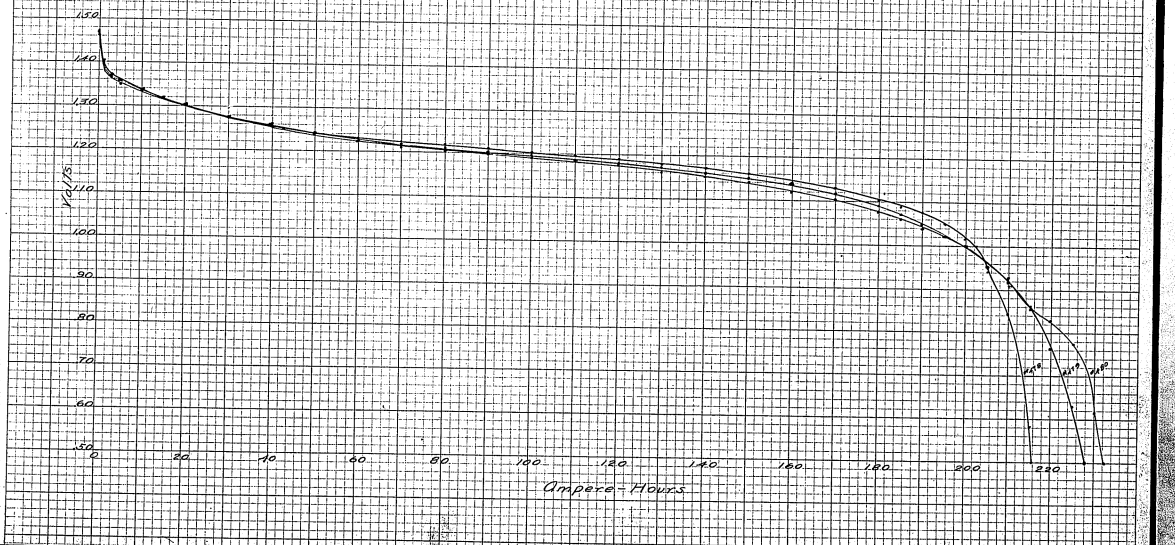


O.4 Cells, #478, #479, #480.

Discharge #122, at 30 Amperes; after a 15 hour charge at 30 amps (Wall 4 hrs)

Cell #478, (Black), Electrolyte: 21.5% KOH + 90 g LiOH			202.5	2165
" #479, (Red),	"	"	" + 105 "	"	200	2288
" #480, (Green),	"	"	" + 120 "	"	200	2322

Edison Laboratory, 6/2/09. Test O.K. - N.H. Plotted by N.C.



A-4 Cells #-481, #-482, #-483.

Life-Curves of Three Similar Cells.

Electrolyte: 8% KOH + 120 g LiOH per litre, then 21% KOH.

Cell #-481:- Black. Cell #-482 = Red. Cell #-483 = Green.

Full line: Output to 1V at 30 amps on 15-hour charge at 30 amps.

Dotted line: " " 1V " 40 " " 7-hour " " " "

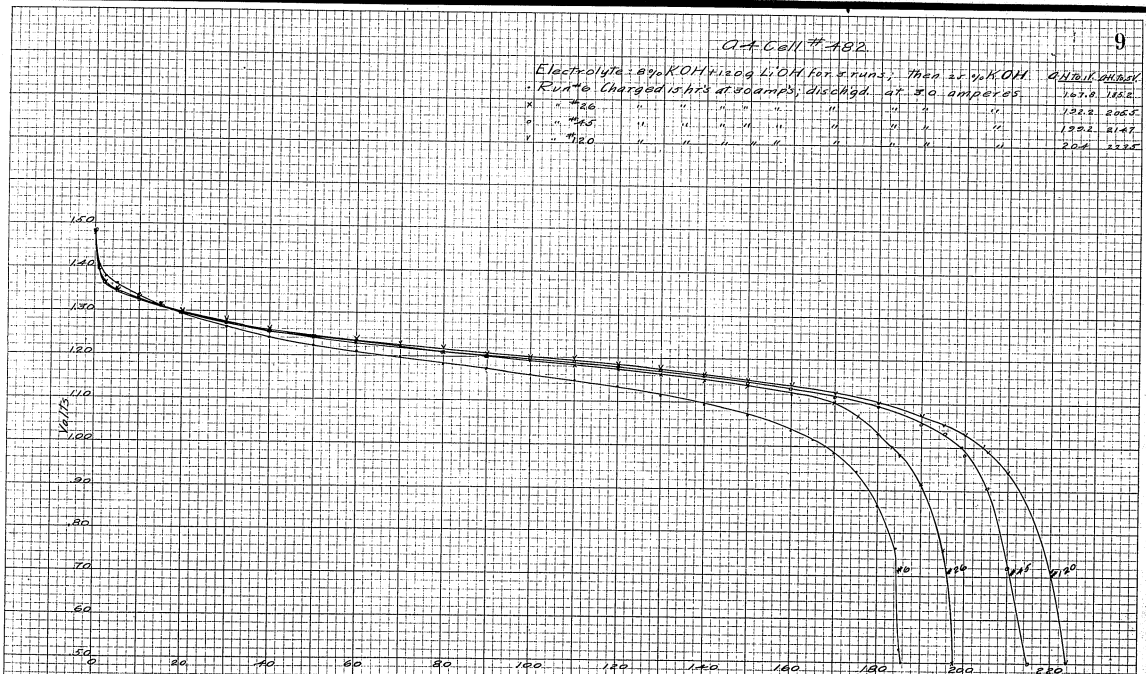
Edison Laboratory. Test O.K. - W.E.H. Plotted by R.C.

A-1 Cell #182.

Electrolyte: 8% KOH + 120 g LiOH for 3 runs; then 2% KOH

Run #26 charged 15 hrs at 30 amps, discharged at 30 amperes.

		Ah to 1.0	Ah to 0.8
X	#26	147.0	182
O	#45	192.2	206.5
V	#120	193.2	214.7
		204	223.5



0-A Cells = 1.94 - 1.89

Electrolyte: 21% KOH + 120 g. LiOH.

Discharge = 23, at 30 Amperes; after a 15 hr charge at 30 amps.

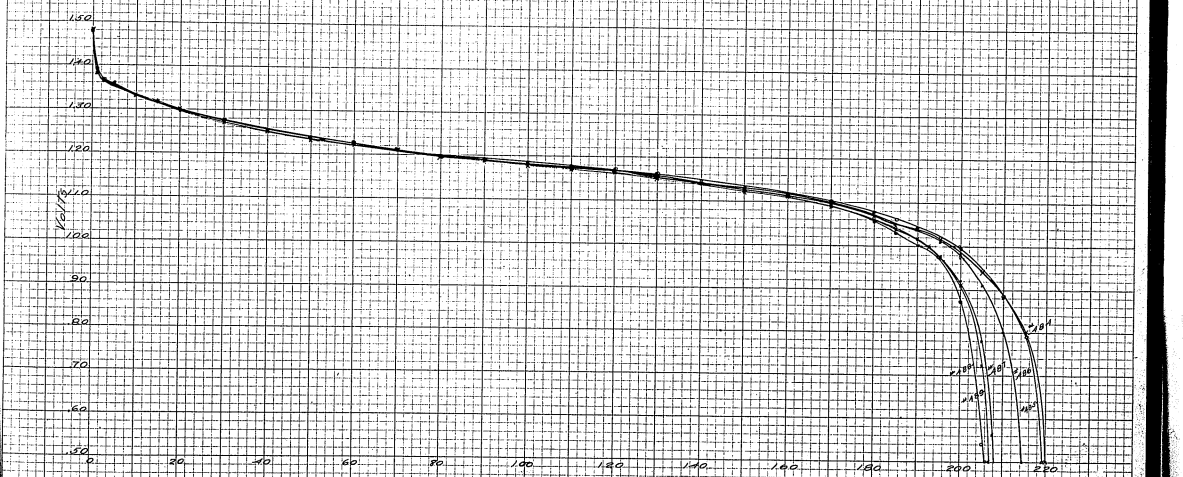
Cells all contain the same $Ni(OH)_2$ and Fe Mix, but the 11 Flake

13 as follows:

10 Cells = 1.94 - 1.86 (Black) = 2 of 11 and = 2 of 13 Flake

= 1.87 - 1.89 (Red) 9 Flake.

Edison Laboratory, 4/8/08. Test OK - LEH. Plotted by H.C.



Q-4 Cell No 486 — Li/S Curve

Electrolyte: 21% KOH + 120 g LiOH

Full line: Output to 1V. at 30 amps. on 1st hour charge at 30 amps.

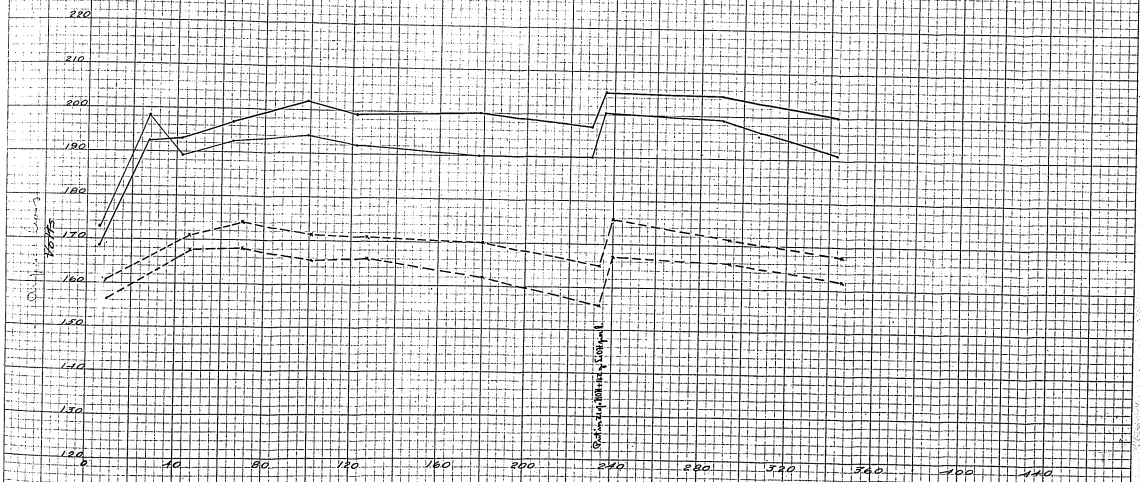
Dotted line: " " .5V. " 40 " " " 1 " " " " " "

Edison Laboratory. Test O.K. — U.C.W. Plotted by H.C.

Black: Cell #331, #743 $Ni(OH)_2$
Red : " #366, #733 $Ni(OH)_2$

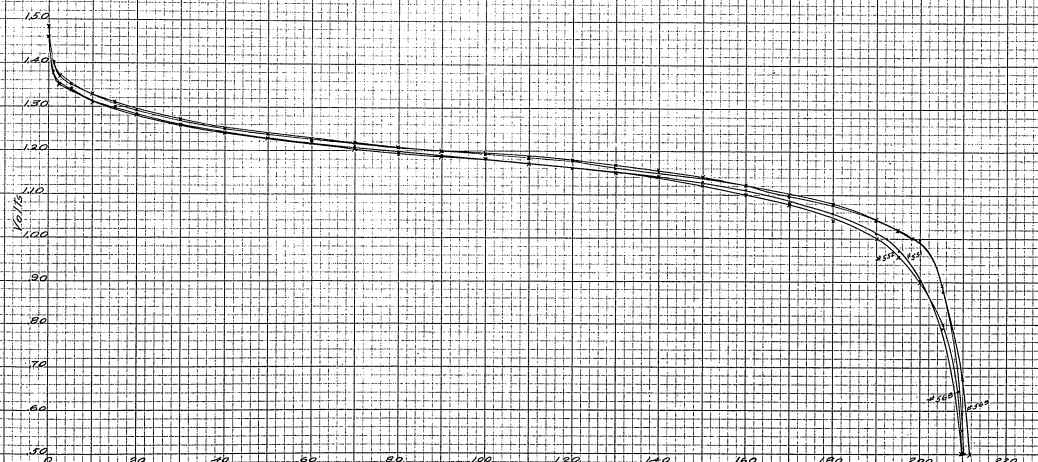
O.A. Cells #331 and #369

Life-Curves of Cells which were Treated Similarly, but which differ as to the $Ni(OH)_2$ in the Tubes.
Electrolyte: 21% KOH + 120 g LiOH for 3 runs, Then 25% KOH
Full line: Output to 1 V at 30 amps on 1-hour charge at 30 amps.
Dotted " " " " " " " " 7 " " " " "
Edison Laboratory. Test. O.K.-WEM Plotted by R.C.



04 Cells #351 & 352 and 368 & 369.

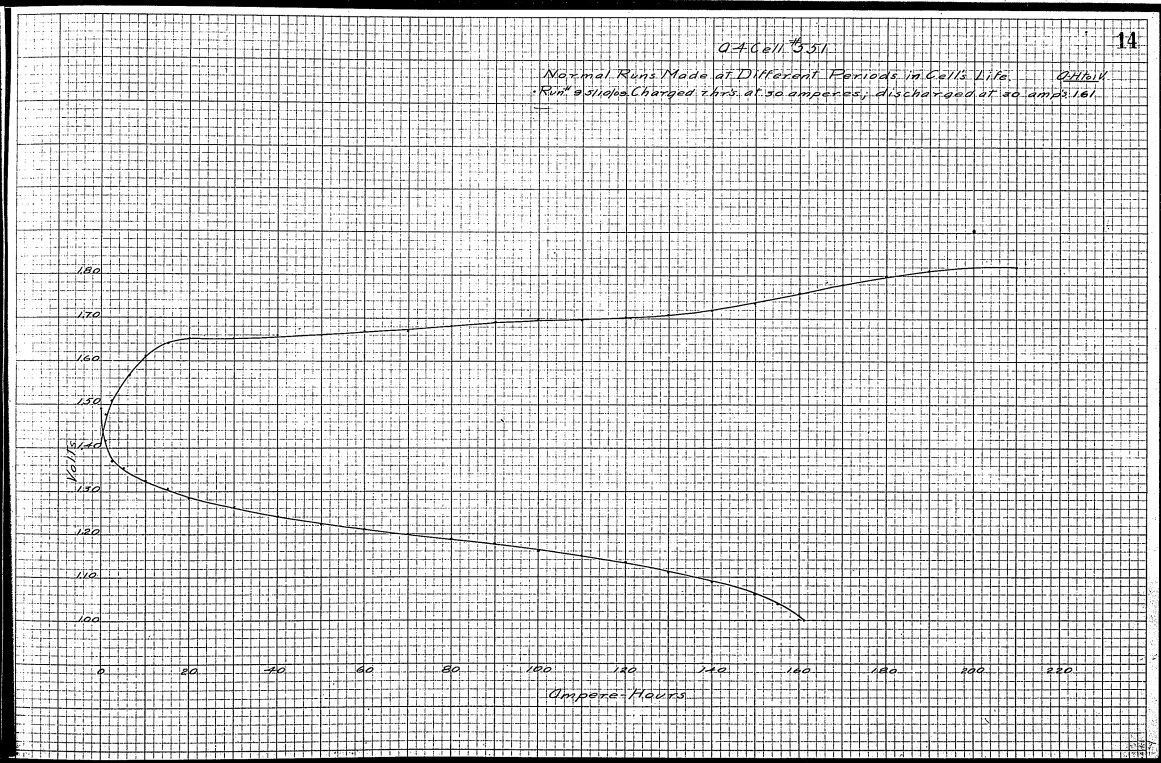
Electrolyte: 21% KOH + 120 g. LiOH for 3 runs, - then 21% KOH.
Discharge #27, at 30 amperes, after 4½-hour charge at 30 amps.
Cells contain some Ni Flake and Fe Mix, but the $Ni(OH)_2$ is different, as follows:
½ Cells #351 & 352, (Black): #143 $Ni(OH)_2$
" " 368 & 369, (Red): #238 "
Edison Laboratory, 5/26/09. Test OK. - W.E.M. Plotted by A.C.



O.A. Cell #351.

Normal Runs Made at Different Periods in Cells Life. Oct 6/14

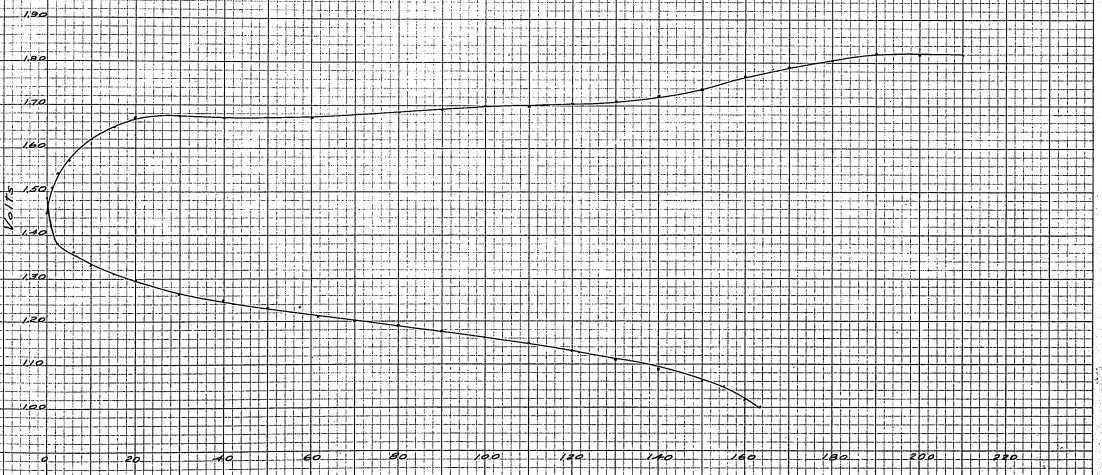
Run #3 16 hrs. Charged 16 hrs. at 30 amperes, discharged at 40 amps. 16 hrs.



O.A. Cell #568

Normal Runs, Made at Different Periods in Cells Life. Actual

Run #3, 4 days Charged 7 hours at 30 amps, discharged at 30 amps 16 a.s



Black: Cell #643, "A" N. Flake
Red: " #646, "B" N. Flake

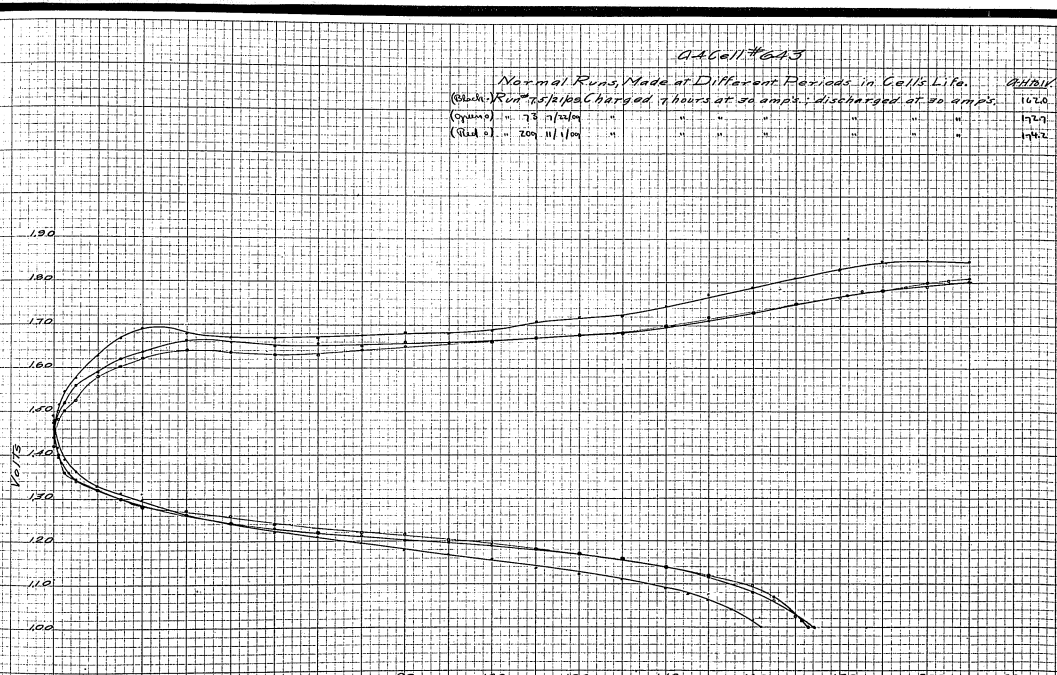
A & B Cells #643 and #646.

Life-Curves of Cells which were Treated Similarly, but which differ as to the N. Flake Used.
Electrolyte: 21% KOH + 100 g LiOH; $Ni(OH)_2$: #841
Full line: Output to 1.1 at 30 amps. on 15-hr. charge at 30 amps.
Dotted " " " " " " 7-hr " " " "
Edison Laboratory, Test O.K.—W.E.H. Plotted by R.C.

A-Cell #643

Normal Runs, Made at Different Periods in Cell's Life.

					A.H. Eff.
(Black)	Run # 5	5/8/04	Charged 7 hours at 30 amps. - discharged at 30 amps.		162.0
(Square)	" 78	7/22/04	" " " " " " "		172.7
(Red)	" 200	11/1/04	" " " " " " "		174.2



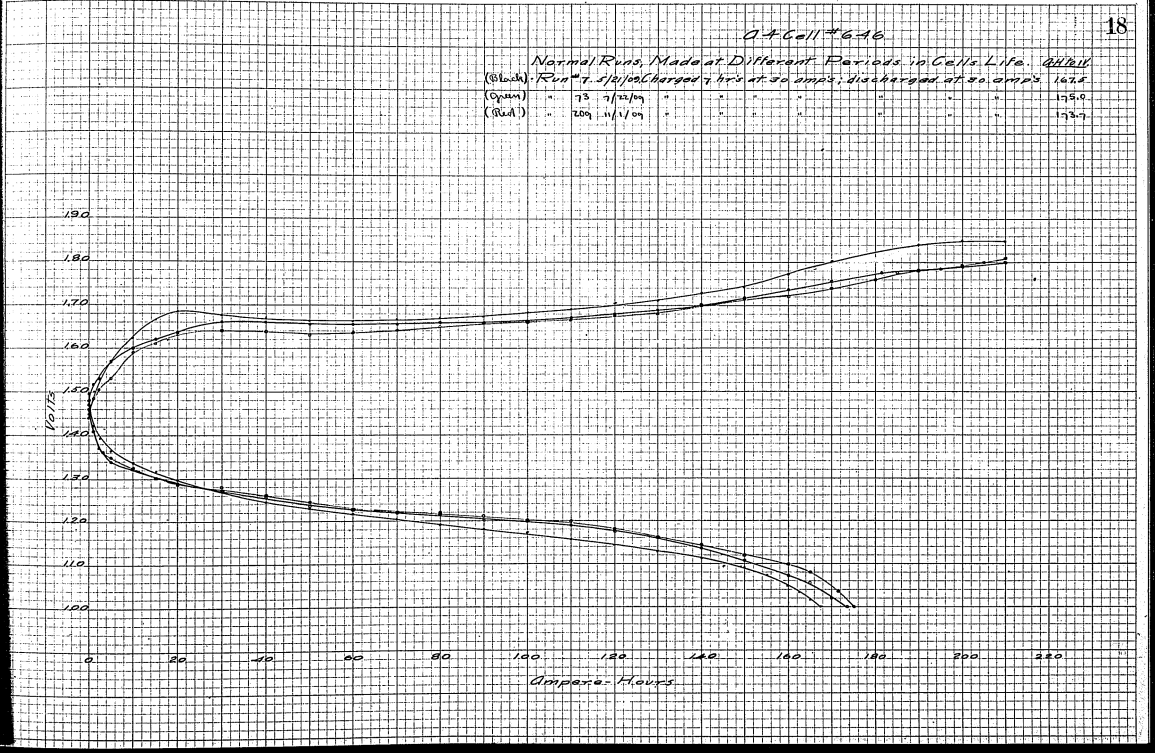
A4 Cell #646

Normal Runs, Made at Different Periods in Cells Life. A4 Cell

(Black) Run #7. 5/2/09 Charged 7 hrs at 30 amps; discharged at 30 amps 167.4

(Green) " 75 7/22/09 " " " " " " " " 175.0

(Red) " 209 11/1/09 " " " " " " " " 173.7



O.A. Cell # 7.7.5. - Life Curve

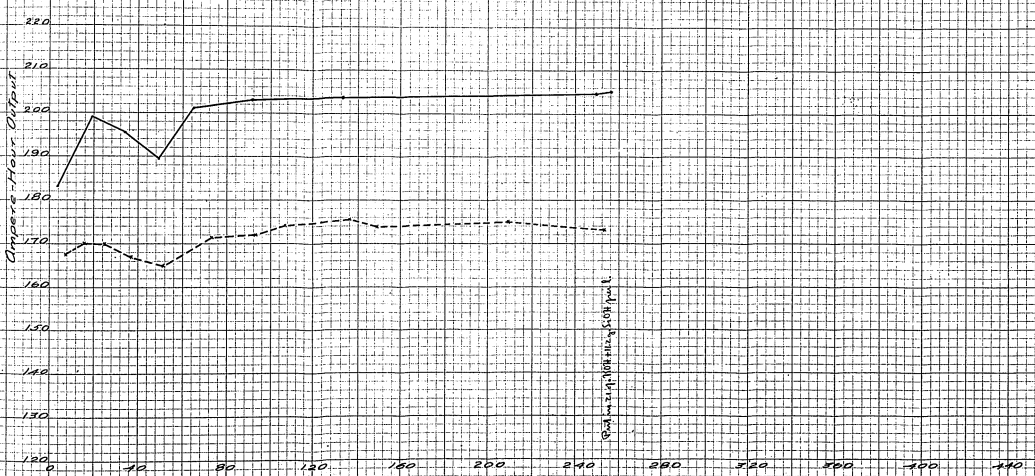
Cell Contains Straight-Cut Pin-Insulators.

Electrolyte: 21% KOH + 100 g LiOH; $NiOH_2$ = .842 w = .843; Flake Ni.

Full line Output to 1.1 V. at 30 amps, on 1-hour charge at 30 amps.

Dotted " " " " " " " " 7-hour " " " "

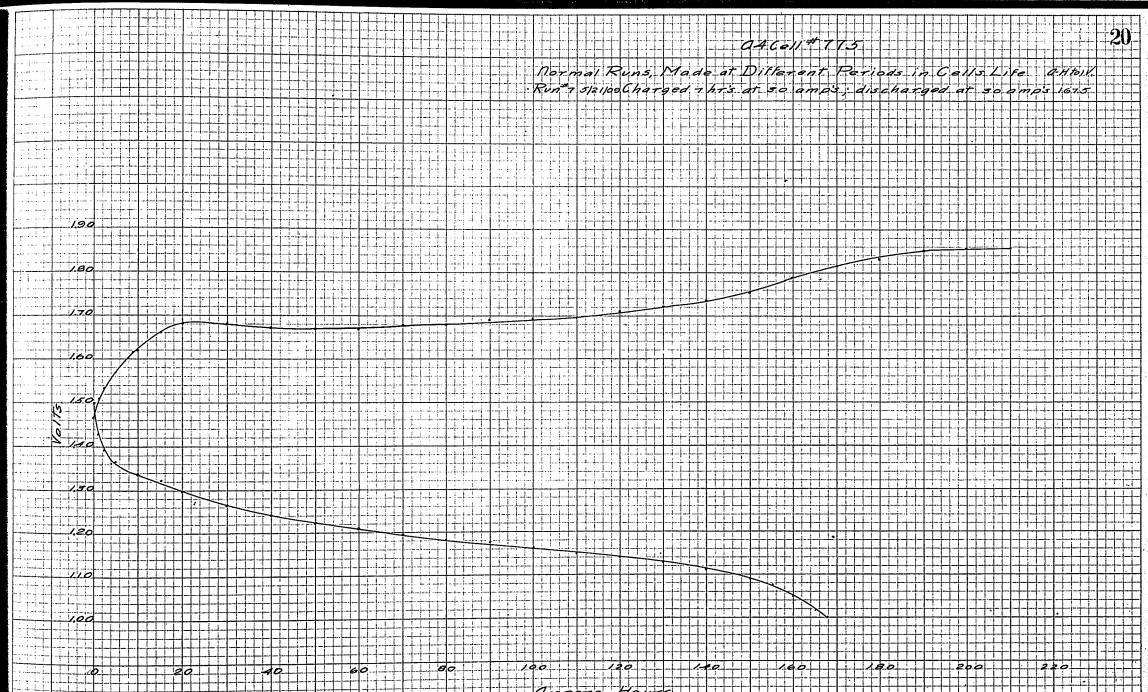
Edison Laboratory. Test O.K. - W.H. Plotted by A.E.



04 Cell # TT3

Normal Runs, Made at Different Periods in Cells Life 6/11/11.

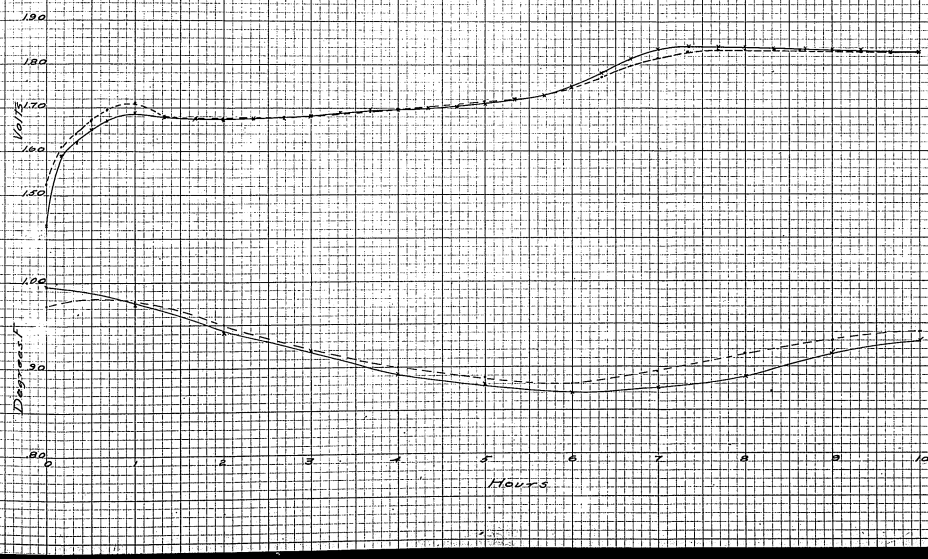
Run #1 3/21/00 Charged 7 hrs. at 30 amps, discharged at 30 amps 1.67.5



A-4 Cells.

Comparison of Charge Curves, and Temperatures during Charge of Cells having Bossed, and Straight-Cut Pin Insulators.

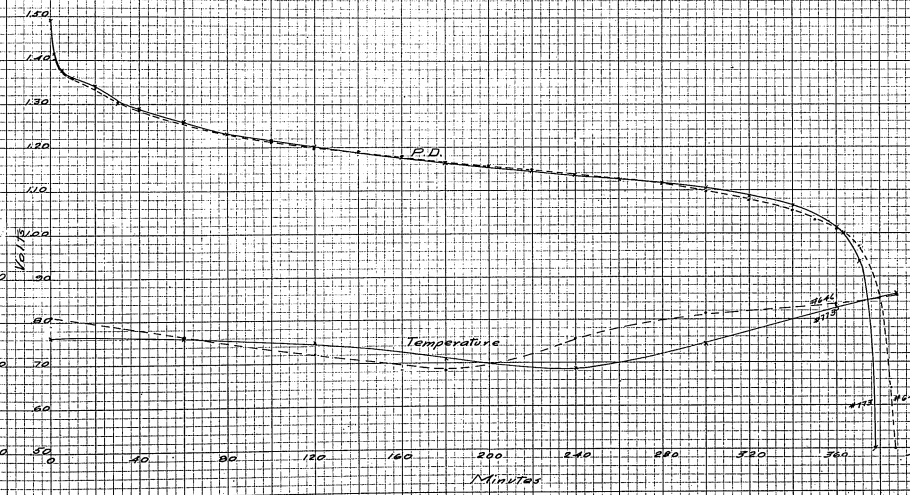
Cell #648 Bossed pins. Electrolyte: 21% KOH + 100g LiOH.
" #773 Straight-cut pins " " " " "
Rate of charge: 30 amperes. Run #4.
Room Temperature practically constant at 75°F.
Edison Laboratory, 5/19/09 Test OK. - W.H. Plotted by R.C.



O.A. Cells

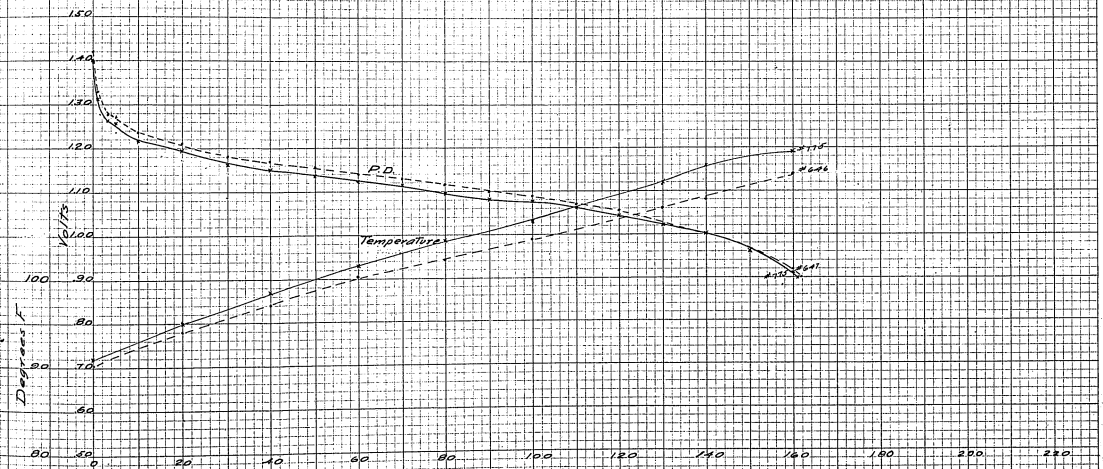
Comparison of Discharge Curves, and Temperature during Discharge, of Cells having Bossed and Straight-cut P.n. Insulators.

Cell 246 Bossed pins. Electrolyte: 21% KOH + 20 g LiOH
" 773 Straight-cut pins " " " " "
Rate of discharge: 30 amperes Run# 4
Room temperature practically constant at 23°C
Edison Laboratory, 5/20/02. Test O.K. — W.E.H. Plotted by A.G.



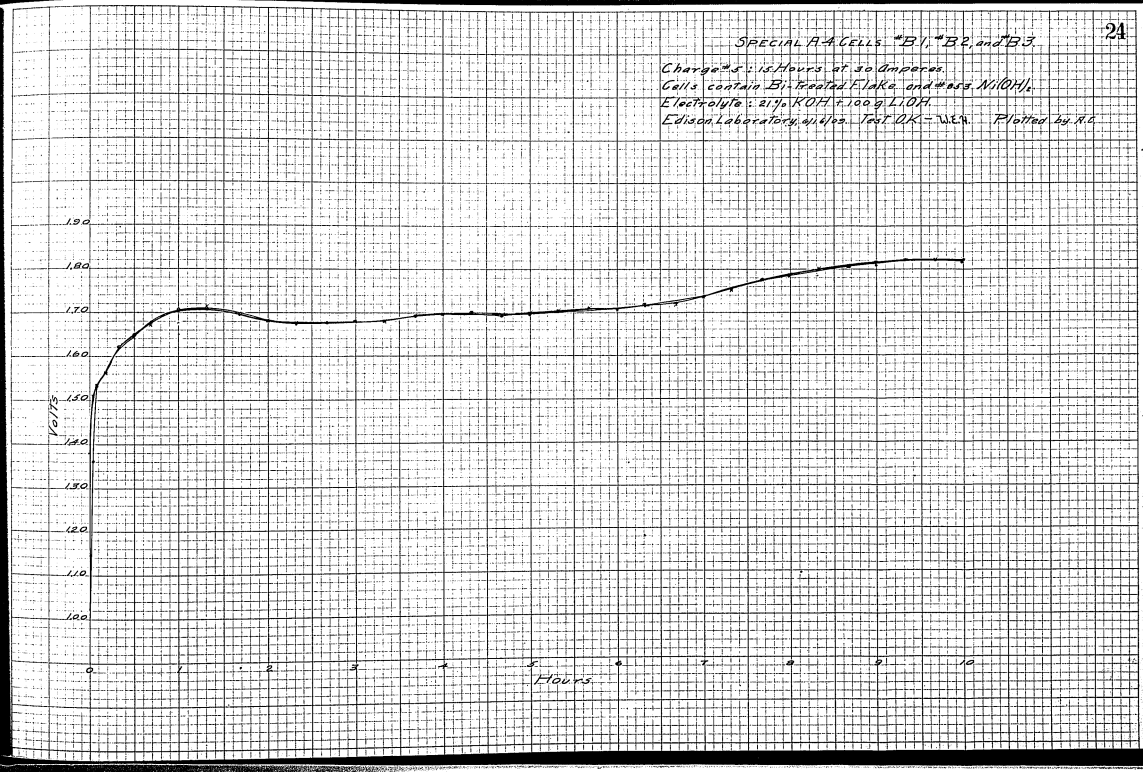
A-4 Cells

Temperature and Volt Curves on a High Rate Discharge.
Cell Case Bored pin-insulators
" Wires Straight-cut pin "
Electrolyte: 21% KOH + 100 g/l LiOH
Discharged at 80 amps after 7 hrs charge at 30 amps
Room temperature constant: 72° F. Run # 13
Edison Laboratory, 5/26/00 Test OK - W.H. Plotted by H.C.



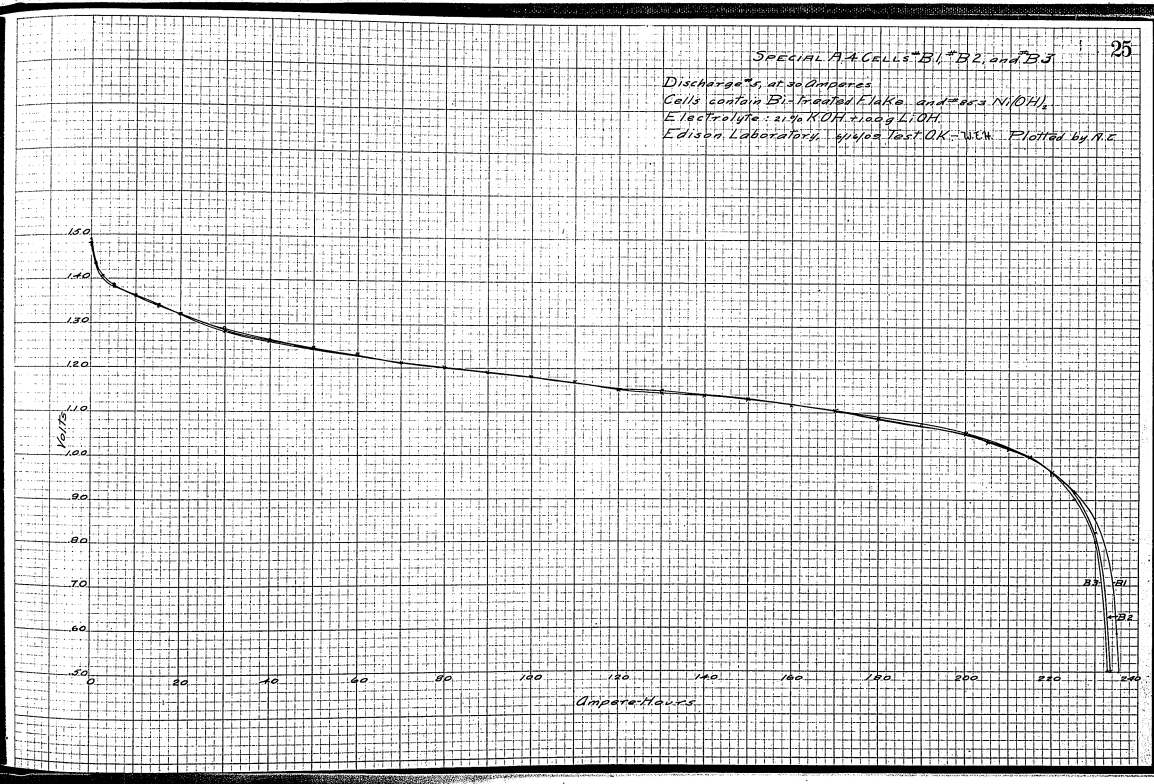
SPECIAL A-A CELLS "B1," "B2," and "B3."

Charge #5: 15 Hours at 30 Amperes.
Cells contain Bi-treated F. flake and #853 Ni(OH)$_2$.
Electrolyte: 21% KOH + 100 g LiOH.
Edison Laboratory, 9/4/03. Test OK – W.E.M. Plotted by H.C.



SPECIAL A-4 CELLS "B1," "B2," and "B3"

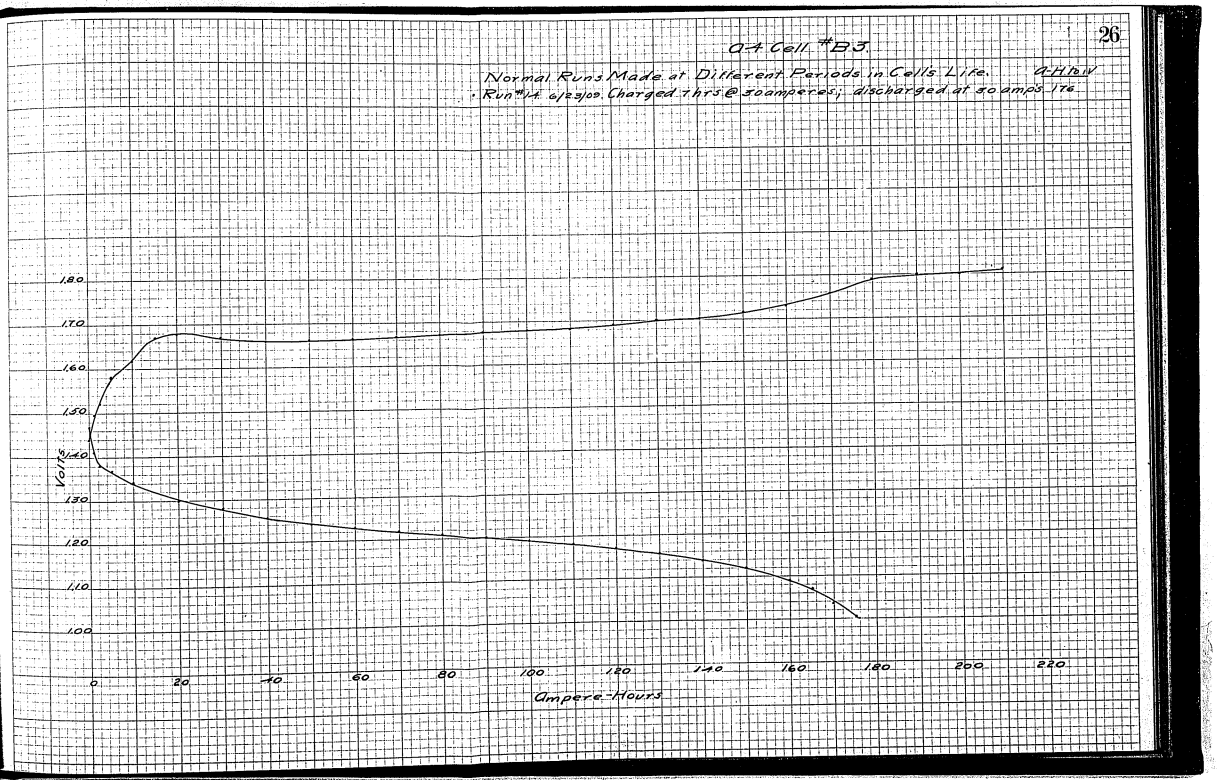
Discharges, at 30 Amperes.
Cells contain Bi-Treated Flake and ~85% $Ni(OH)_2$
Electrolyte: 21% KOH + 10g LiOH.
Edison Laboratory, 9/4/08 Test OK - W.T.H. Plotted by A.C.



0-4 Cell #B3.

Normal Runs Made at Different Periods in Cells Life. 6-11-09

Run #4 6/23/09. Charged 7 hrs @ 30 amperes; discharged at 30 amps 17c.



A4 CELLS "B1 – B3" – LIFE CURVE.

Cells contain Bi-treated Flake and "993 $Ni(OH)_2$

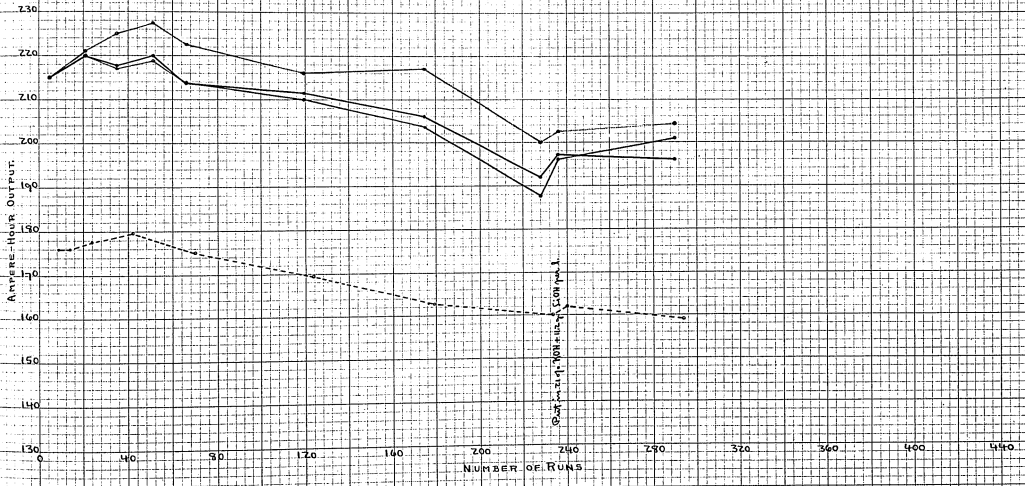
Electrolyte: 21% KOH + 100 g. LiOH

Full line: Output to 1V. at 30 amps. on 15-hour charge at 30 amps.

Dotted " : " " " " " " 7-hour " "

Edison Laboratory, 6/15/09 to W.E.M.

Green – "B1
Red – "B2
Black – "B3



A4 CELL #774

Discharge after Standing, Compared with Normal Runs made Before and After the Stand Test.

Charge: 15 hrs at 30 amps; discharge rate: 30 amps.

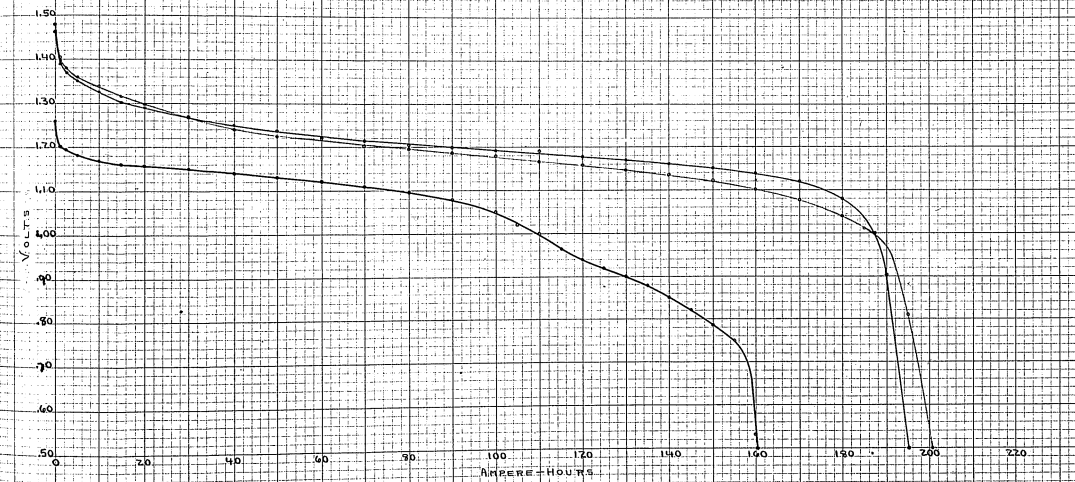
Discharge #54 (Black) Discharge made 6 weeks after the charge.

" #49 (Red) Normal run made before stand test.

" #55 (Green) " " " after " "

Electrolyte: 21% KOH + 100 g SiO_2.

Edison Laboratory, 8/16/09. W.E.H.



A-E Cells #643, 646, 775.

Curves Showing Output Obtainable in One Day by Supplementing the Normal Charge with a Double-rate Boost during the Noon Hour.

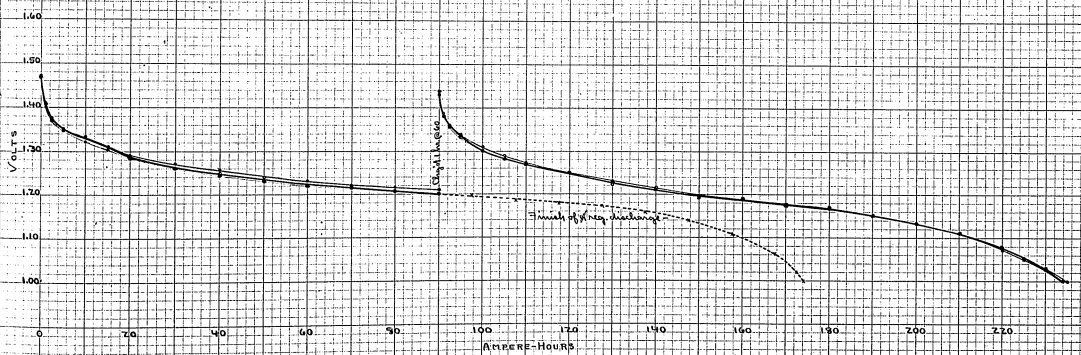
Run #110. Charged 17 hrs. @ 30 amps and, after 90 A-H discharge, 1 hr. @ 40 amps more. Discharge rate: 30 amperes.

Run #110: Total Output 270 A-H; 1st. Output 234 A-H; A-H Eff. 94.9 %.

Reg. run: " " 210 " " " 142 " " 93.0 "

Edison Laboratory, 8/25/09. W.E.H.

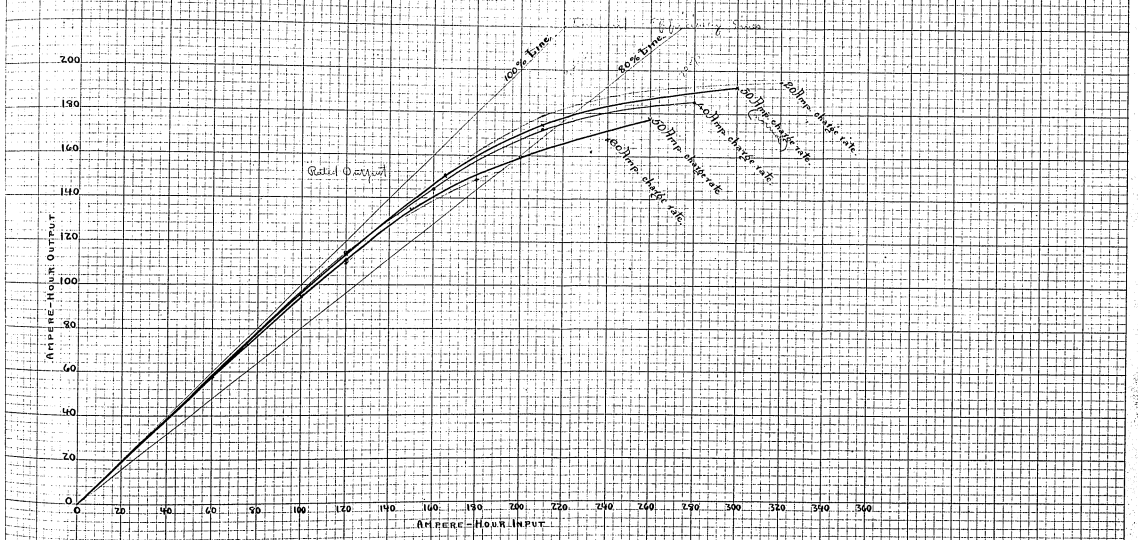
Black - #643
Red - #646
Green - 775



Edison Storage Battery
Type "A" Cell.

Relation of Ampere-hour Output at Normal Rate to Ampere-hour Input at Different Rates.
Each point is the average result of two or more tests of three cells (642, 646, & 675).
Runs 171-220. The high rate charges were made first, and at each rate the tests were made on descending inputs.

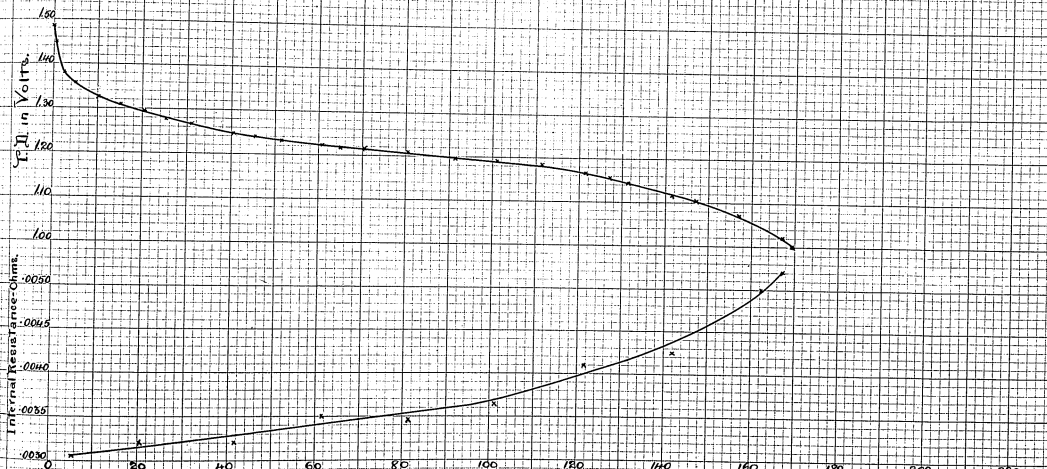
Edison Laboratory 10/11 to 11/16 - 1909. Curve by - W.E.H.



Edison Storage Battery
Type A-1 Cell

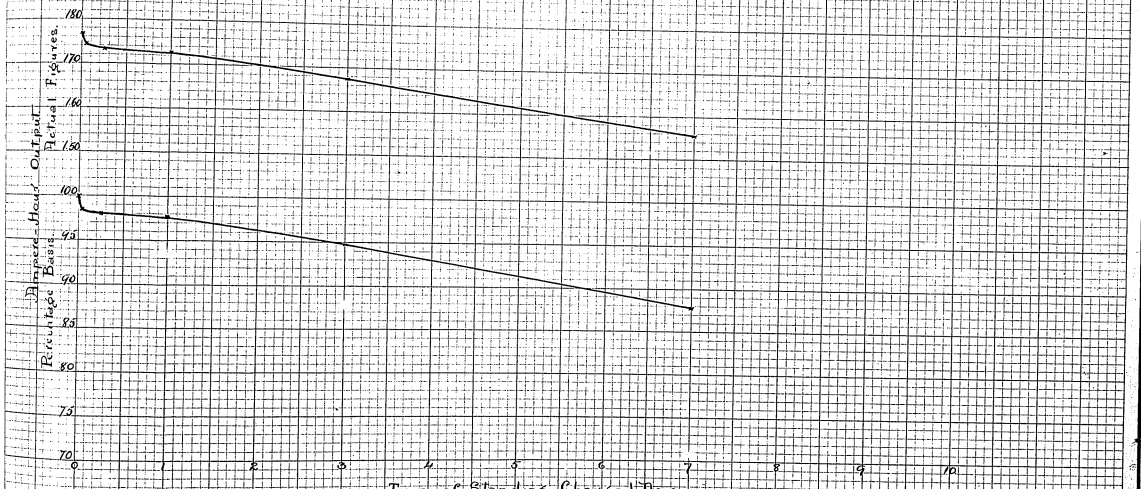
Note: As these cells still contained their original solution after standing, it was probably quite weak.

Internal Resistance Curve, calculated from voltage changes produced by 30 Ampere increases of current.
Readings are the double average of two runs (#233 & 234) of two cells (#635 & 646)
Cells were charged 7 hrs @ 30 amps & discharged @ 30 amps, the rate during discharge being increased to 60 Amps for 1 min. @ intervals of 10 min.
Edison Laboratory, 11-19-09. Curve by H.C. Approved by W.E.H.



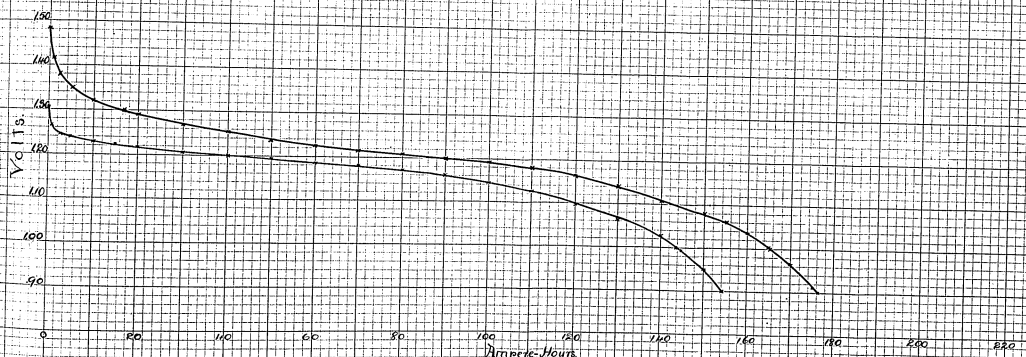
Edison Storage Battery
Type A 4 Cell

Rate of loss of Charge on Standing (at Temperature of 75°F)
Charged normally, 7 hrs at 30 Amps, discharged to 0.9 V. at 30 Amps.
Points averaged from results of cells 645, 646, 775-runs 236-243 (The solution had not been renewed in these cells since the beginning, & it was probably quite weak.)
Edison Laboratory, 11/23-12/8-1909. Curve by H.C. Approved: T.E.M.



A-4 Cell 646

Discharge made One Week after Charge, compared with a normal Discharge.
Cell charged 7 hrs at 30 Amps. discharged to 1.9 V at 30 Amps.
×Run 236. Discharge started 5 minutes after charge at a temperature of 89° F.
×Run 245. Discharge started 1 week after charge at a temperature of 75° F.
Edison Laboratory, 12-8-09. Curve by J.C. Approved: W.E.H.

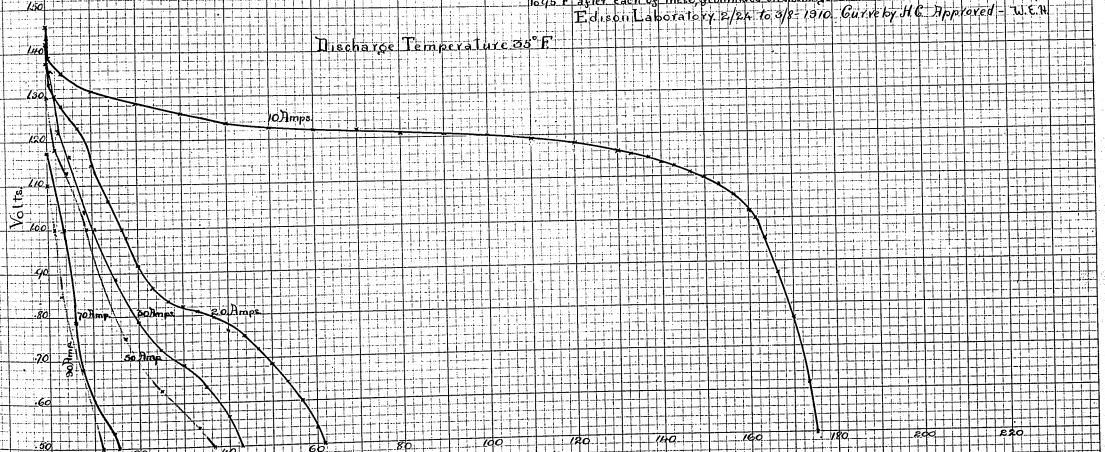


"Ha" Cell 643 Temperature Tests.

Charges at 95°F - 50 Amps for 7 Hours.
Discharges at 35°F, at different rates.
Run 294 (Black) Discharge rate 10 Amperes
" 296 (Red) " " 30 "
" 299 (Green) " " 50 "
" 302 (Violet) " " 70 "
" 305 (Yellow) " " 90 "
" 305 (Blue) " " 20 "

The discharge was started one hour after the end of charge in each case.
As only a part of the capacity is given out on a cold discharge, the cell was warmed up to 95°F after each of these, & continued on discharge at the same rate until 50V was reached again.

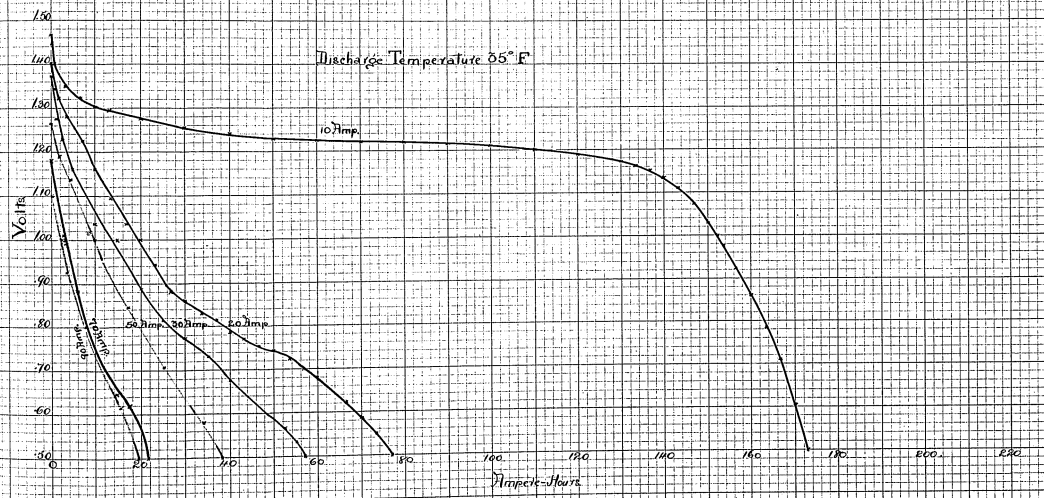
Edison Laboratory 2/24 to 3/8 - 1910. Curve by H.C. Approved - W.E.H.



"A4" Cell B1. Temperature Tests

Run 312 (Black) Discharge rate 10 Amperes.
" 314 (Red) " " 30 "
" 317 (Green) " " 00 "
" 320 (Violet) " " 70 "
" 321 (Yellow) " " 110 "
" 323 (Blue) " " 50 "

Charged at 86° F-30 Amps for 7 Hours. Discharges at 35° F at different rates.
The discharge was started one hour after the end of charge in each case.
As only a part of the capacity is given out on a cold discharge, the cell was warmed up
to 96° after each of these & continued on discharge at the same rate until 60V was reached again.
Edison Laboratory, 12/Jan to 3/8 - 1910. Curve by H.C. Approved: W.E.M.

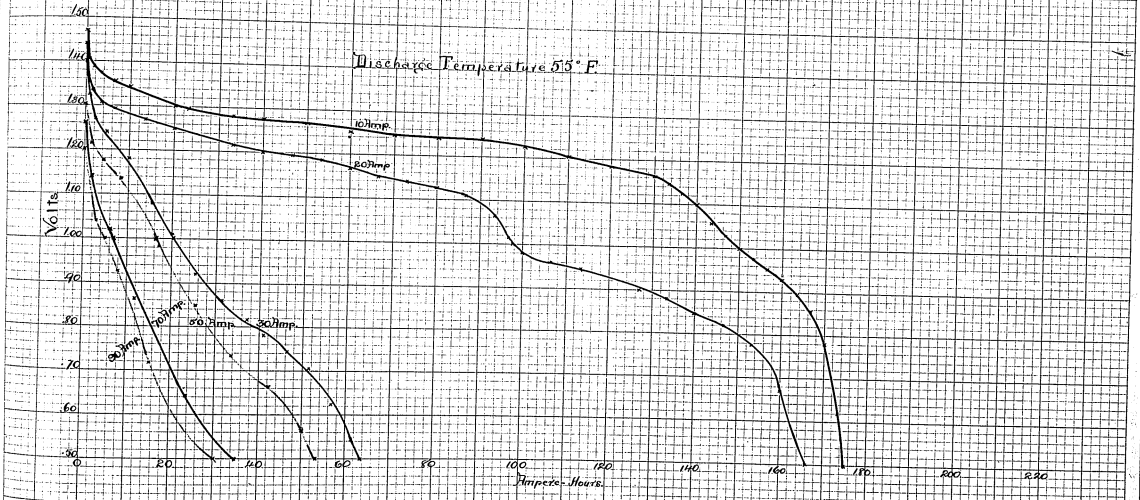


Run "307 (Black) Discharge rate 10 Amperes
" 308 (Blue) " " 20 "
" 313 (Red) " " 30 "
" 314 (Green) " " 50 "
" 317 (Violet) " " 70 "
" 318 (Yellow) " " 90 "

Ni-Fe Cell 643 Temperature Tests.

Charges at 95° F. - 30 Amps for 7 Hours - Discharges at 55° F. at different rates.
The discharge was started one hour after the end of charge in each case.
Not only a part of the capacity is given out on a cold discharge, the cell was warmed up to 95° F after each of these 5 continued on discharge at the same rate until 1.5V was reached again.
Edison Laboratory. 3/11 to 3/25 - 1910 Curve by H.C. Approved C.E.N.

Discharge Temperature 55° F.

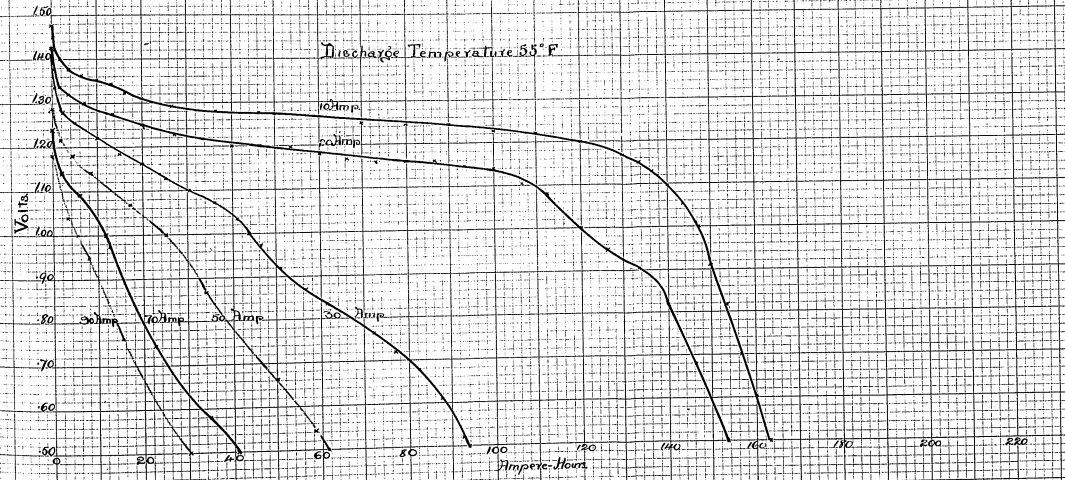


A4" Cell. B1. Temperature Tests.

Run 328 (Black) Discharge rate 10 Amperes.
" 327 (Blue) " " 20 "
" 331 (Red) " " 30 "
" 332 (Green) " " 50 "
" 326 (Violet) " " 70 "
" 326 (Yellow) " " 90 "

Charges at 105° F. - 30 Amps. for 7 Hours - Discharges at 55°F at different rates
The discharge was started one hour after the end of the charge in each case.
No only a part of the capacity is given out on a cold discharge, the cell was warmed up to 95°F.
after each of these discharges & continued on discharge at the same rate until 60V was reached again.

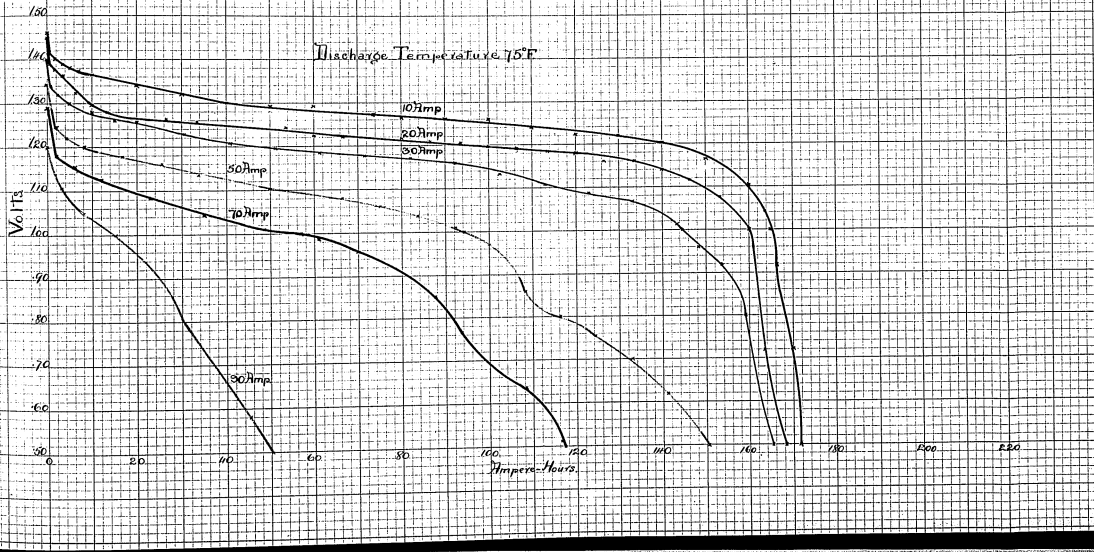
Edison Laboratory, 3/11 to 3/22 - 1910 Curve by H.C. Approved: W.C.H.



"A" Cell 643. Temperature Tests.

Run 320 (Black) Discharge rate 10 Amperes.
" 321 (Blue) " " 20 "
" 325 (Red) " " 30 "
" 330 (Green) " " 50 "
" 331 (Violet) " " 70 "
" 333 (Yellow) " " 90 "

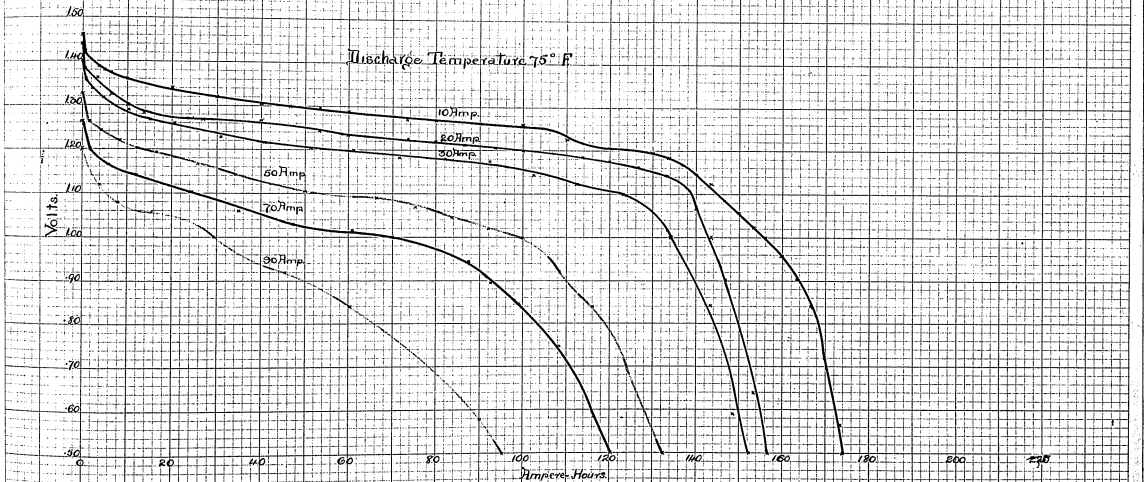
Charges at 95° F - 30 Amps for 7 Hours. Discharges at 75° F at different rates
The discharge was started one hour after the end of the charge in each case.
As only a part of the capacity is given out on a cold discharge, the cell was warmed up to 98° F after each of these 5 continued on discharge at the same rate till 1.60 V was reached again.
Edison Laboratory. 3/28 to 4/8 - 1910. Curve by H.C. Approved - W.E.M.



A4 Cell B1 Temperature Tests.

Charges at 95°F.- 30 Amps. for 7 Hours.- Discharges at 75°F.- at different rates.
The discharge was started one hour after the end of charge in each case.
As only a part of the capacity is given out on a cold discharge, the cell was warmed up to 95°F. after each of these, & continued on discharge at the same rate, until 1.50V was again reached.
Edison Laboratory, 3/25 To 4/5-1910. Curve by MC. Approved- W.E.W.

Run 333 (Black.) Discharge rate 10 Amperes
" 333 (Blue.) " " 20 "
" 343 (Red.) " " 30 "
" 348 (Green.) " " 50 "
" 349 (Violet) " " 70 "
" 367 (Yellow) " " 90 "

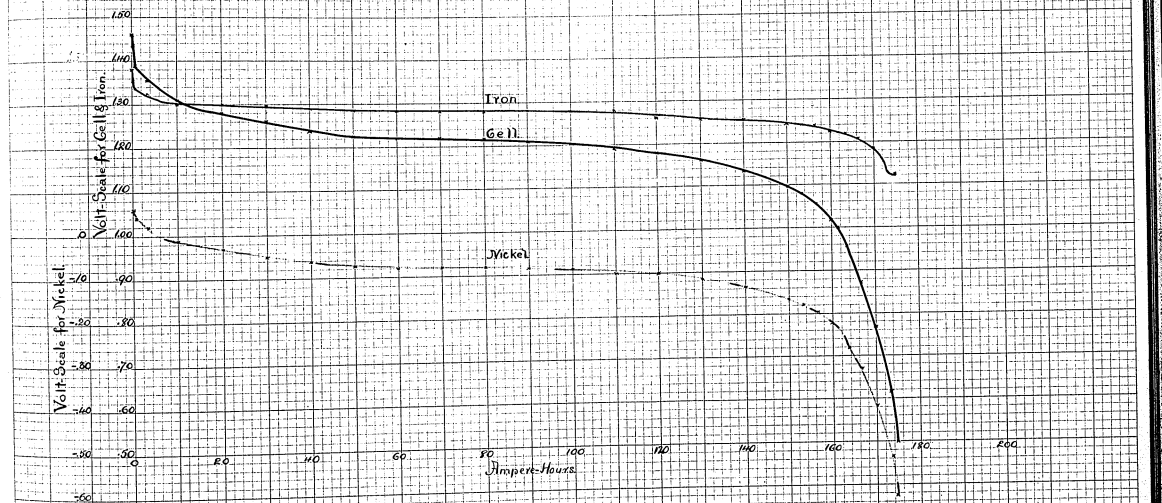


"A4" Cell 643

Discharge Curve with Individual Electrode Readings by W.C.B.

Run 294. Discharged at 10 Amps at 65°F starting 1 hour after the end of a normal 7 Hour charge.

Edison Laboratory, 2/22/10. Curve by H.C. Approved-W.H.

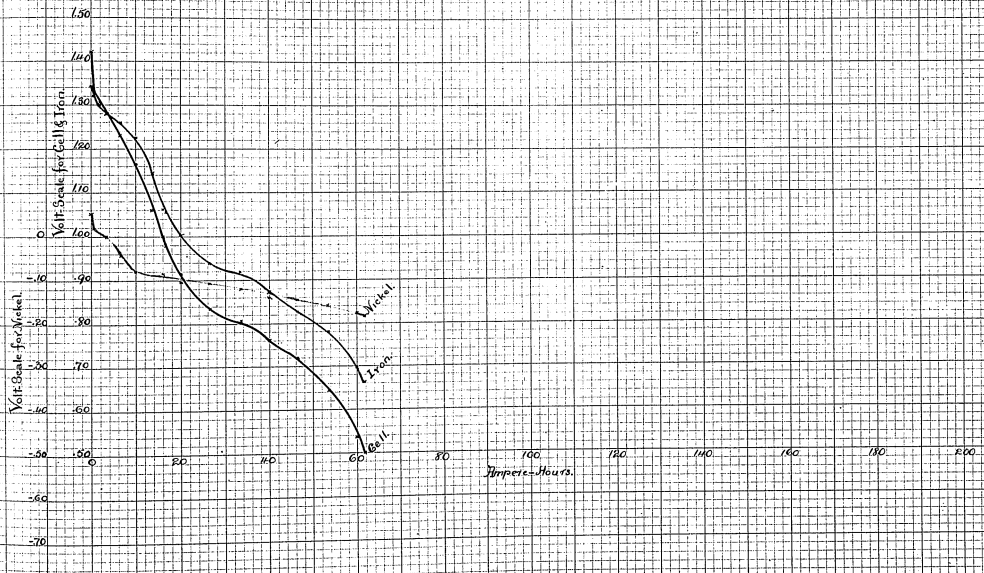


No. 4 Cell 693.

Discharge Curve with individual Electrode Readings by M.C.

Run 305. Discharged at 20 Amps. at 35° F. starting 1 hour after a normal 7 Hour charge.

Edison Laboratory. 5/8/10. Curve by H.C. Approved - W.E.H.

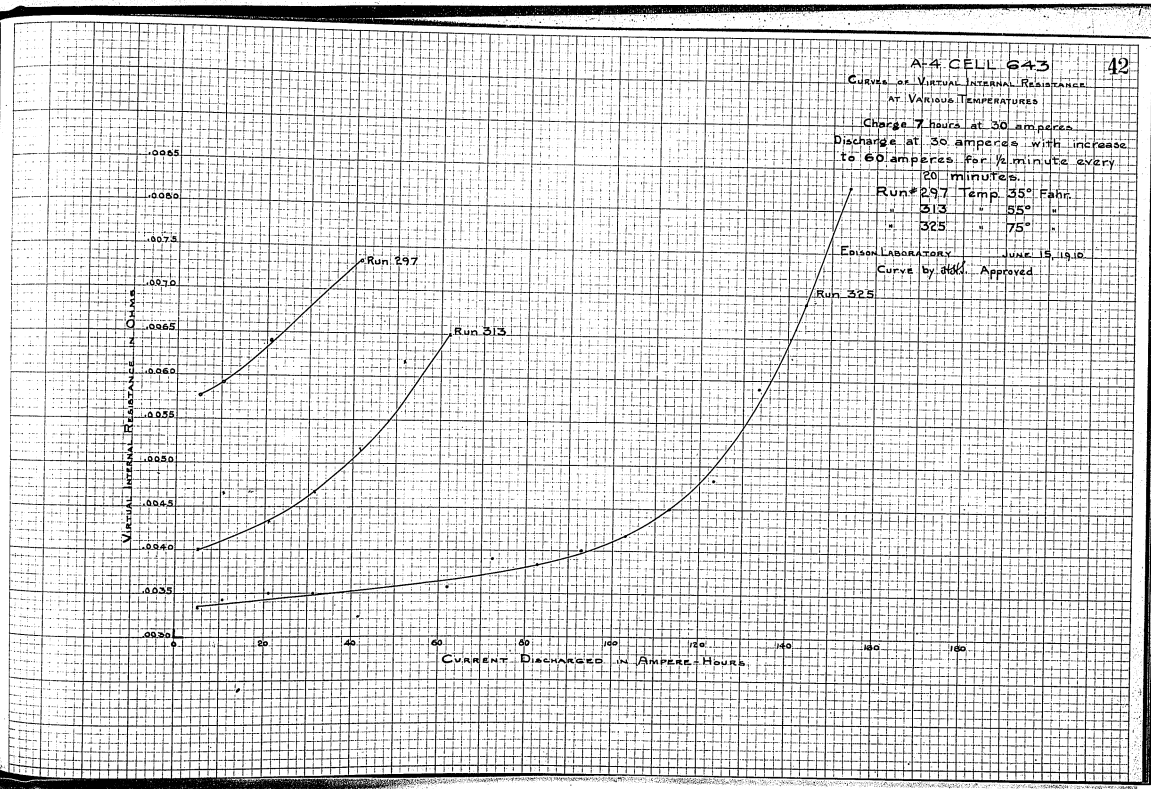


A-4 CELL 643

CURVES OF VIRTUAL INTERNAL RESISTANCE AT VARIOUS TEMPERATURES

Charge 7 hours at 30 amperes.
Discharge at 30 amperes with increase to 60 amperes for ½ minute every 20 minutes.
Run # 297 Temp. 35° Fahr.
" 313 " 55° "
" 325 " 75° "

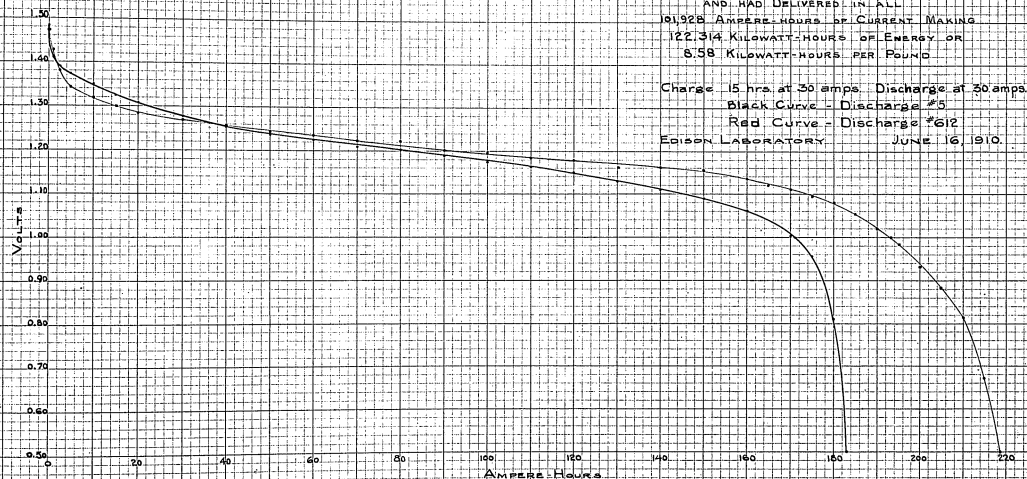
EDISON LABORATORY JUNE 15, 1910
Curve by HHK. Approved

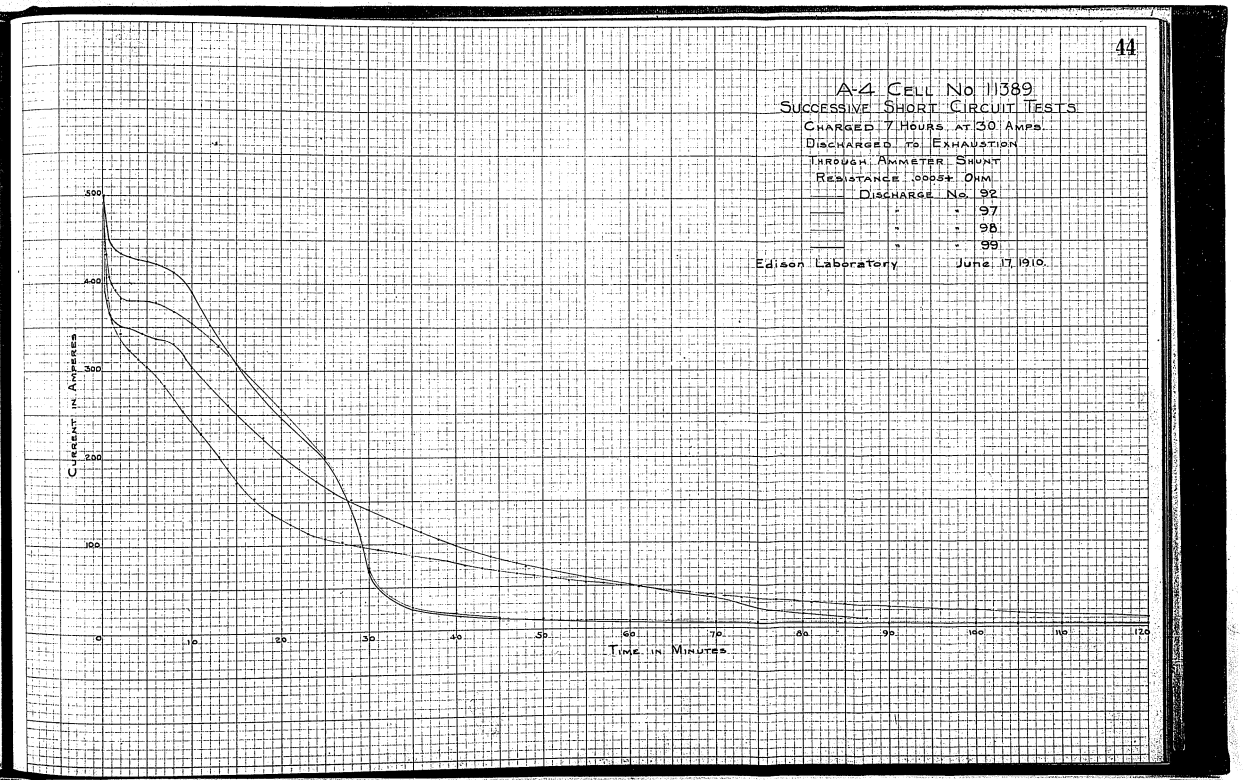


A-4 Cell Nº 468

Normal-rate Discharge of Cell when New
Compared with the Same after it had had
612 Complete Charges and Discharges
and had Delivered in all
161,928 Ampere-hours of Current Making
122,314 Kilowatt-hours of Energy or
8.58 Kilowatt-hours per Pound

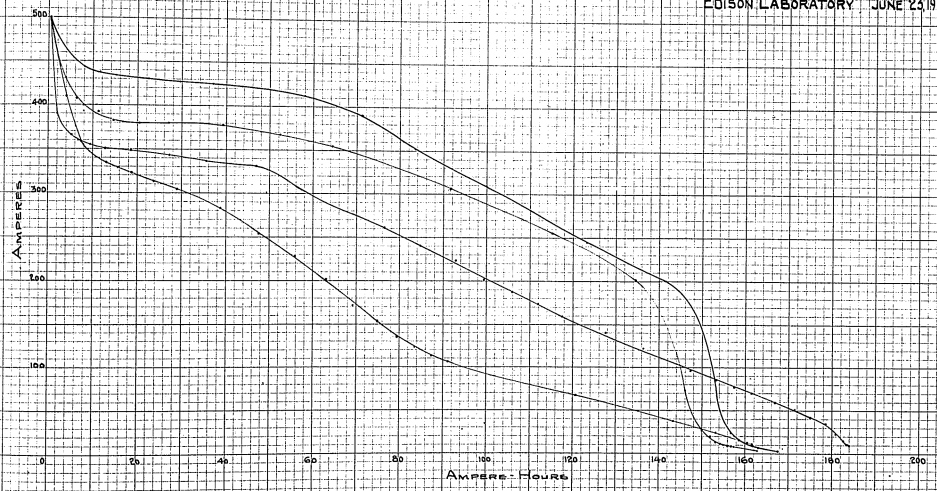
Charge 15 hrs. at 30 amps. Discharge at 30 amps.
Black Curve - Discharge #5
Red Curve - Discharge #612
Edison Laboratory. June 16, 1910.




A-4 Cell No 1389
Successive Short Circuit Tests
Charged 7 Hours at 30 Amps.
Discharged to Exhaustion
Through Ammeter Shunt
Resistance .00054 Ohm.
Discharge No. 92
" " 97
" " 98
" " 99
Edison Laboratory June. 17. 1910.
Current in Amperes
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
100
110
120
Time in Minutes

A-4 CELL Nº 11389

SHORT CIRCUIT TESTS
SAME RUNS AS ON PAGE 44
PLOTTED TO AMPERE-HOUR SCALE
EDISON LABORATORY JUNE 23 1910.



A-4 CELL No 11389

DISCHARGES AT DIFFERENT RATES

AFTER NORMAL CHARGES OF 7 HOURS AT 30 AMPERES

DISCHARGE #63 AT 30 AMPERES AV. TEMP. 86.8° F.

" 66 " 60 " " " 107.1 "

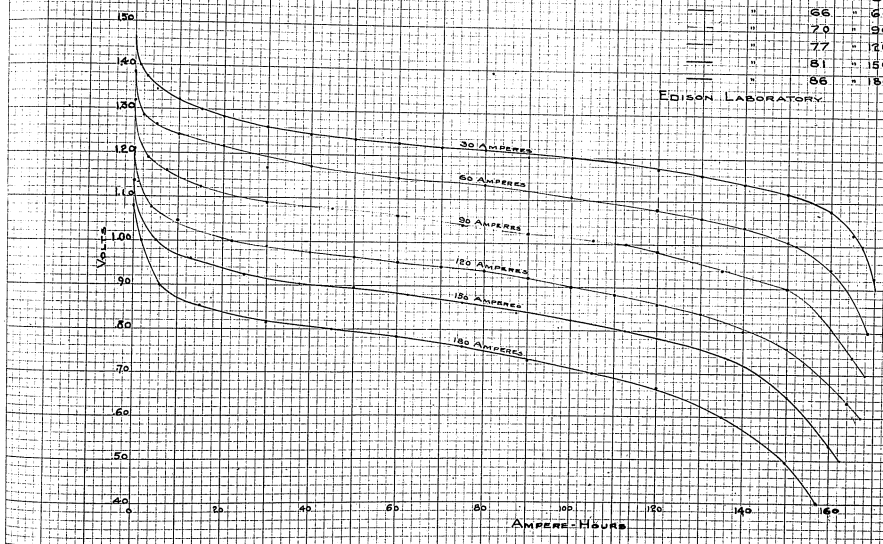
" 70 " 90 " " " 113.6 "

" 77 " 120 " " " 116.4 "

" 81 " 150 " " " 130.7 "

" 86 " 180 " " " 133.6 "

EDISON LABORATORY. JULY 5, 1910.



TABLE

RUN	AMP.HR. OUTPUT	WATT-HR. OUTPUT	AVERAGE VOLTAGE
63	170	205	1.205
66	168.5	188	1116
70	168	170	1.011
77	167	151	.905
81	162.5	135	.831
86	157	115	.733

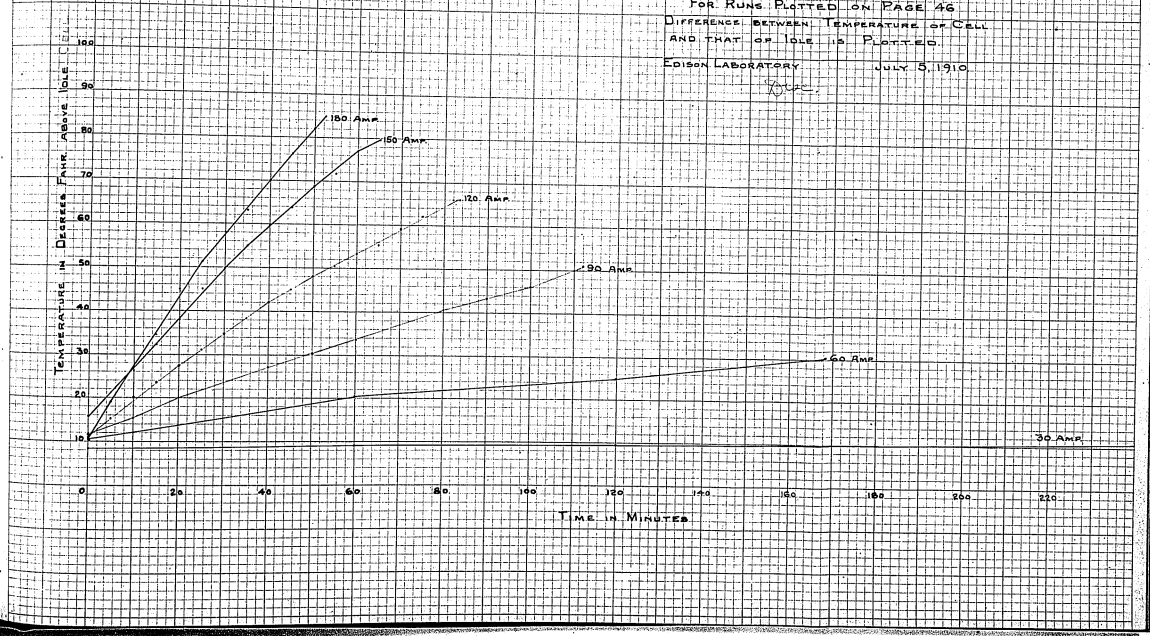
A-4 CELL No 11389

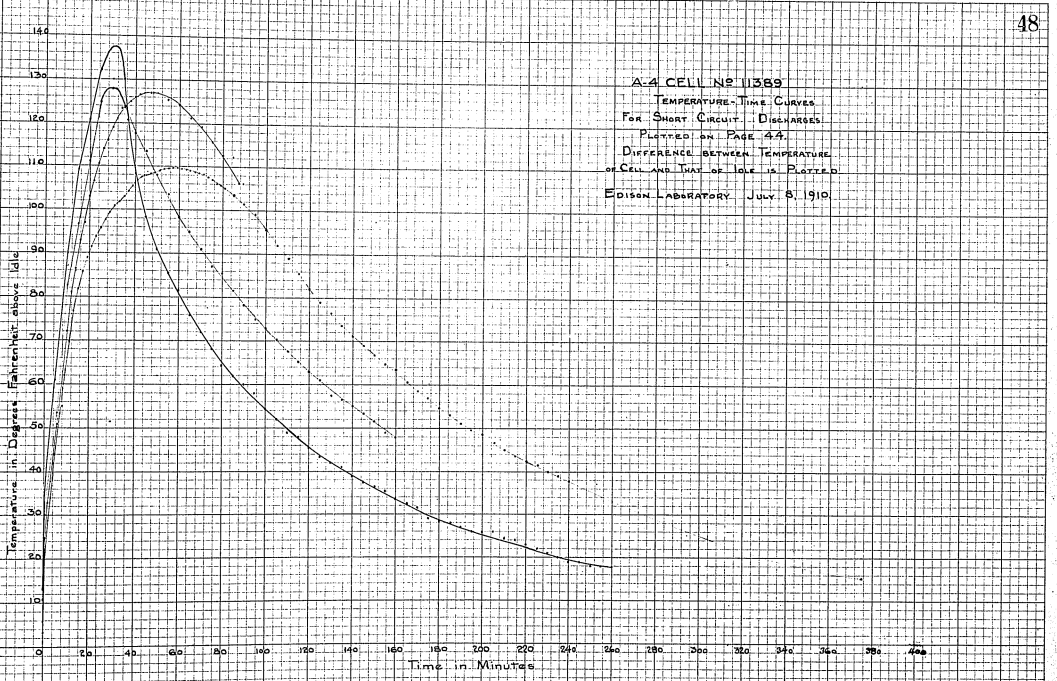
TEMPERATURE-TIME CURVES

FOR RUNS PLOTTED ON PAGE 46

DIFFERENCE BETWEEN TEMPERATURE OF CELL AND THAT OF IDLE IS PLOTTED.

EDISON LABORATORY. JULY 5, 1910.





A-4 CELL No 11389

TEMPERATURE-TIME CURVES

FOR SHORT CIRCUIT DISCHARGES

PLOTTED ON PAGE 44.

DIFFERENCE BETWEEN TEMPERATURE OF CELL AND THAT OF IDLE IS PLOTTED

EDISON LABORATORY JULY 8, 1910.

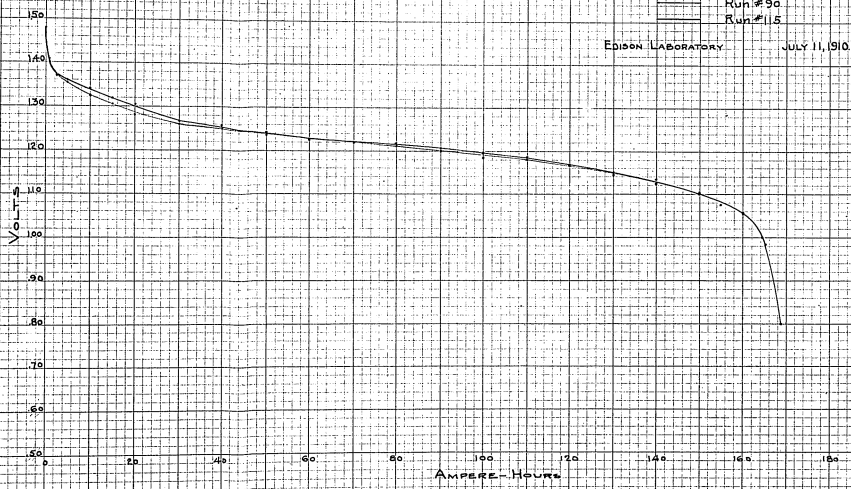
A-4 CELL Nº 11389.

COMPARISON OF NORMAL-RATE DISCHARGES BEFORE AND AFTER NINE SHORT-CIRCUIT DISCHARGES.

Run #90

Run #115

EDISON LABORATORY JULY 11, 1910.



A-4 CELL Nº 11389.

COMPARISON OF HIGH RATE DISCHARGES

BEFORE AND AFTER

NINE SHORT CIRCUIT DISCHARGES.

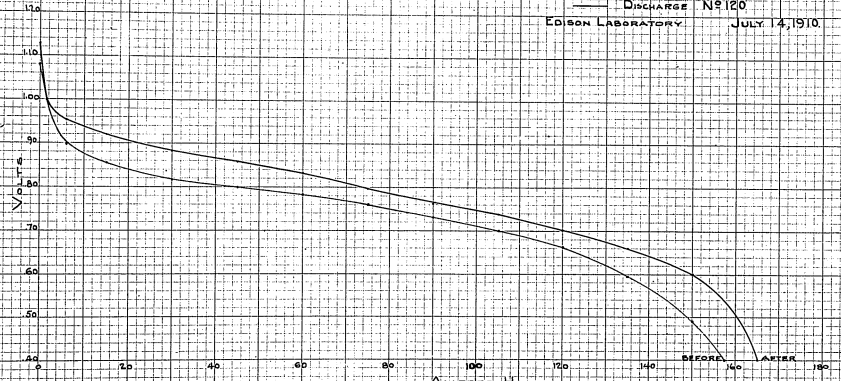
CHARGES 7 HOURS AT 30 AMP.

DISCHARGES AT 150 AMP.

——— DISCHARGE Nº 86.

——— DISCHARGE Nº 120

EDISON LABORATORY. JULY 14, 1910.



A-8 CELLS 267 & 270

CURVES SHOWING COMPARISON OF DISCHARGES FOLLOWING NORMAL CHARGE AND OVERCHARGE

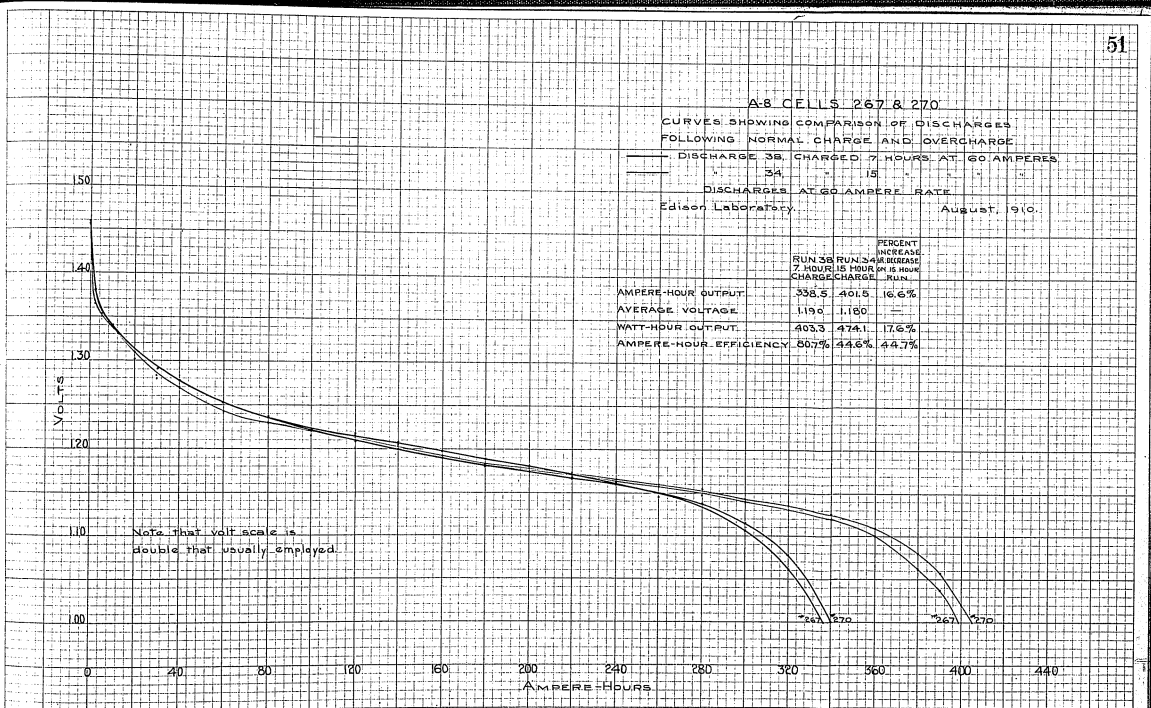
——— DISCHARGE 38, CHARGED 7 HOURS AT 60 AMPERES

– – – " 34, " 15 " " " "

DISCHARGES AT 60 AMPERE RATE

Edison Laboratory. August, 1910.

	RUN 38 7 HOUR CHARGE	RUN 34 15 HOUR CHARGE	PERCENT INCREASE OR DECREASE 15 HOUR RUN
AMPERE-HOUR OUTPUT	338.5	401.5	16.6%
AVERAGE VOLTAGE	1.190	1.180	—
WATT-HOUR OUTPUT	403.3	474.1	17.6%
AMPERE-HOUR EFFICIENCY	80.7%	44.6%	44.7%



A-4 CELL No. 15328

—INTERMITTENT SHORT CIRCUIT—

CHARGED 15 HRS. AT 30 AMP.

DISCHARGED, AFTER STANDING 33 DAYS,

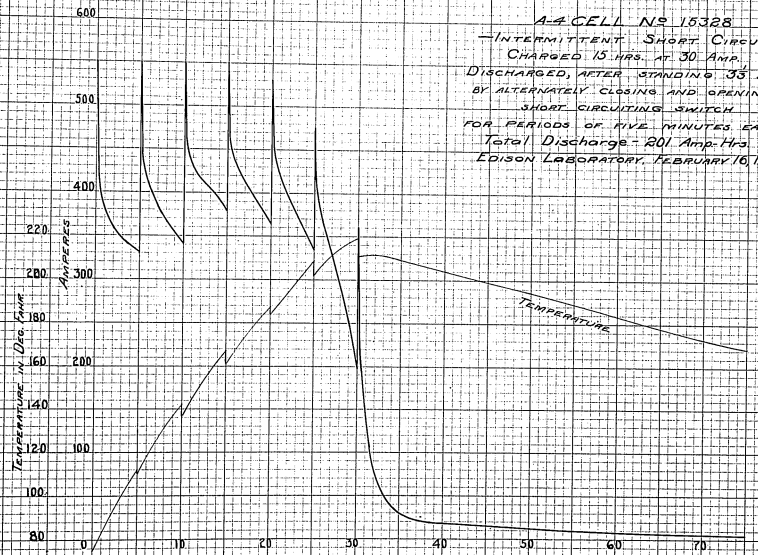
BY ALTERNATELY CLOSING AND OPENING

SHORT CIRCUITING SWITCH

FOR PERIODS OF FIVE MINUTES EACH.

Total Discharge - 201 Amp-Hrs.

EDISON LABORATORY, FEBRUARY 16, 1911.



AUG. 87.